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CORRIGENDA

The following corrections to Table D (pp. 21–22) of the 1958 Annual Report are notified:—

Maize and Maize Meal, Coast Province: Total Value should read £9,890, not £99,890.

Total Value, 1958, Coast Province: should read £537,432 not £627,432.

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PART I—AGRICULTURE IN 1959

Review of the Year

The shake-down which took place in some of Kenya's agricultural industries in 1958 put them in a position to benefit from commodity prices which improved somewhat as 1959 went on. Agricultural development, arising from planning and investment in recent years by Government and private enterprise, was evident in 1959 in the fields of land consolidation, farm planning and farm lay-outs, in cash crops and plantation development. This has created the need for and an increasing demand from the farming communities for the expansion of research and advisory services to meet the problems thrown up by more intensive farming and to provide the guidance to raise yields and quality of the wide range of crop and livestock products for which Kenya is well known and is well able to produce.

It was most unfortunate that this should coincide with a reduction in the Government funds available to meet all its commitments and that there had, therefore, to be a cut back in staff and finance available to various sections of the Agricultural Department of as much as 15 per cent which thereby limited its ability to pursue its task of developing the basic economy of the country. One experiment station, one agricultural training centre and one soil conservation unit were closed down and the field and research staff were reduced by 22 Assistant Agricultural Officers and Technical Officers and by 61 Technical Assistants and other E Scale staff. While it is Government's responsibility to provide the basic research and advisory services to farmers, nevertheless as farming industries prosper, it is meet and right that they should themselves contribute to their own specialized needs. The efforts and contributions of the tea, coffee, sisal, pyrethrum, cereals and pineapple growers towards their own research needs have been recorded in past reports. During the year under review, wattle growers have met the cost of a wattle inspector in Western Kenya, the Central Province Marketing Board has applied a cess to coffee to provide expansion of coffee advisory staff and a working party on African tea development has proposed the provision of additional specialist tea staff by a Tea Authority, to be recovered from the expanding crop. The demand for expanded research and field services, however, remained from the much wider field of general farming development.

A phenomenon occurred in 1959 which had almost been forgotten over the past three years of very good rainfall—drought east of the Rift and shortage of rain elsewhere. Following upon poor short rains in 1958, the long rains of 1959 were inadequate and resulted in failure of crops in the drier areas and local shortages of food for the African population. It also had an adverse effect on the country's economy by the arrest of the expansion of the coffee crop, by the difficulty of the pyrethrum industry in supplying anticipated demand and by a setback to grazing and the industries dependent on it. However, the wheat crop has been freer from rust than for some years, promised a crop of some 1,400,000 sacks and was of a quality that permitted the reduction of admixture of hard wheats from 15 per cent to 10 per cent for baking flour to be fixed from 1st May, 1960, reducing 1960 wheat imports and ensuring that there would be no substantial carry-over of surplus wheat. The smaller maize crop of 1,378,000 bags

of white maize and 147,000 bags of yellow maize will almost exactly cover the needs of human consumption and livestock feeds and so relieves the newly-established Maize Board of an export problem in 1960. Food shortage in Southern Province, the first for three years, will take up about 30,000 bags. The Coast Province produced particularly good crops of cotton (7,000 bales) and cashew nuts (4,000 tons), a welcome boost to its economy.

Land Management

Steady progress towards better farming continued. The acreage under planned farms in the Highlands rose from 212,266 acres at the end of 1958 to 326,260 at the end of 1959, the year's planning being greater than that of any previous year. In some areas nearly one-third of the farms have been planned, most of them have made a success of it and the expenditure on farm planning services results in a permanent improvement to the economy of the country which will make itself increasingly evident over the next few years. There remained a long list for farm planning any many farmers were helping to prepare their own plans and thus spread the load on departmental staff.

In the African highlands over 4,000 feet the progress with land consolidation and farm lay-outs continued. A fruit of the labours of the last four years was the enactment of the Land Control (Native Lands) and the Native Lands Registration Ordinances, which at last permitted the registration of titles to land after consolidation and gave progressive farmers access to hard credit from banks against the security of their titles to their farms. In Central Province the completion of land consolidation and demarcation in Kiambu and Nyeri Districts and progress in Embu, Fort Hall and Meru had placed these areas for the first time in history in a position to develop intensively their very valuable land on a secure basis. Holdings have been consolidated on 820,049 acres, 111,746 freehold titles, including plots in new villages, have been registered and banks have issued 65 loans to individual farmers against the security of their land, a small figure but a significant step in our plan for African agriculture. Significant too was the visit and report of Mr. H. M. Williams, I.C.A. Consultant on Agricultural Credit and Director of the Farmers' Home Administration, United States Department of Agriculture, arranged by the United States International Co-operation Administration, on the needs, organization and administration of rural credit for developing farmers with little modern farming knowledge and little security to offer. With a grant of £100,000 from I.C.A. for loans to African farmers and hopes of expanding loan funds from other sources, efficient and beneficial use of these funds at cheap cost to the farmer, resulting from development to date, can now make a most significant contribution to farming advancement.

Two very real dangers were under consideration during the year. The advantages gained by land consolidation could be flung away if subdivision of holdings below the size which will permit the holder to make a decent living is again permitted and the views of the Department on this danger were made unequivocally clear. Secondly, the funds and staff available to the Department have proved to be inadequate to meet the suddenly increased demand for the planting of cash crops, for farm lay-outs and for the services which the people are demanding after consolidation.

In other Provinces steady progress was made with enclosure, land exchange for the consolidation of holdings and with the development of grazing management schemes based on the improvement of water supplies and the fitting of livestock populations to the carrying capacity of the land. Much of the consolidation effected was by the voluntary exchange of land with guidance where it was required to assist with suitable lay-outs of holdings, roads of access and so on.

Achievement to date, remarkable in that it has come about in so few years, is probably best illustrated by the following table:—

Province	Enclosure, Land Consolidation and Grazing Management	
	Land enclosed and consolidated Acres	*Land under grazing Management Schemes Acres*
Central	820,049	394,170
Nyanza	350,594	—
Rift Valley	137,900	440,000
Rift Valley—Samburu ..	—	1,200,000
Southern (Ukambani) ..	—	538,000
Coast	6,115	70,000
	1,314,658	2,642,170

Enclosure and land consolidation is a pre-requisite to any sound system of farming. The policy begun in 1957 of placing greater emphasis on providing large numbers of farmers with simple farm lay-outs, rather than detailed farm plans for a selected few, was expanded during the year because of the increasing demand from amongst the potential 500,000 African farmers, half as many more as there are in England and Wales. In Central Province the completion of 7,000 farm lay-outs brought the total to 13,644, while in Nyanza the number reached 2,512. In the Divisions of Kiambu, from 15 to 20 per cent of all holdings of over four acres now have farm lay-outs.

Mixed Farming Livestock Enterprises

Livestock production is assuming an increasingly significant place in the output of the Highlands. Besides the 2,000,000 acres of grassland in the ranching areas, of the 3,000,000 acres in the mixed farming areas, 550,000 acres are under cultivation, the remainder being under grass or grass leys (216,500 acres). This broadening of the base of agriculture may be attributed to the operations of the Increased Production of Crops Ordinance, its successor, the Agriculture Ordinance, to rehabilitation and development loans with their emphasis towards stock production, the farm planning services and the veterinary health services.

There has been a considerable increase in the number of dairy cows and the total number of dairy animals since 1957. Although there has been no real increase in total milk and butterfat production between 1958 and 1959, this can be attributed to the variation in weather conditions, 1958 being a good milk producing year, 1959, normal. There was a slight increase in the total payments to farmers. The average price of butterfat went up by 10 cents to Sh. 2/60 per lb., while the price of whole milk dropped about 6 cents from Sh. 2/10 per gallon. Butter and ghee exports dropped about 800,000 lb. to 8,108,422 lb. The rise in the number of cows and the firmer butterfat prices gave promise of an increase in dairy production if 1960 were a normal milk-producing year.

	Dairy Cows	*Total Dairy Animals*	*Whole Milk Gallons*	*Butterfat lb.*
1957 ..	139,000	399,000	—	—
1958 ..	143,000	411,000	10,972,000	11,562,000
1959 ..	152,000	427,000	11,775,000	10,988,000

The increase in the number of beef cows and the total number of beef animals has been steady over the last three years. Sales to the Kenya Meat Commission from European areas rose from 86,000 to 100,000 and from African areas from 25,000 to nearly 44,000 head. The existing firm prices and the firm market, together with the total increase in stock, indicated that there was likely to be a further rise in 1960.

	Beef Cattle in Highlands	
	Cows	*Total*
1957 ..	116,000	484,000
1958 ..	121,000	506,000
1959 ..	128,000	532,000

For sheep, comparative statistics for 1957-59 were not available for breeding stock, but the total number of sheep held on farms and the number of woolled sheep have increased substantially. Much of this rise was due to interest by European farmers in woolled sheep and the rise is expected to continue for the next two or three years. The fact that deliveries to the Kenya Meat Commission only rose from 37,344 to 49,812 from European farms was due to the big demand for breeding stock while the deliveries to the Commission of African sheep and goats dropped slightly from 131,176 to 128,618.

	Sheep on European Farms	
	Total	*Woolled Sheep*
1957 ..	445,000	305,000
1958 ..	488,000	353,000
1959 ..	549,000	412,000

The pig industry was slow to shake off the difficulties through which it passed in 1958. To the reduction in prices to the producer and the general instability of the market can be attributed the drop between May and December, 1959, from 70,700 to 57,300 in the total number of pigs held and from 7,780 to 5,979 in the number of sows. In December and January, 1960, baconer prices were raised by the Uplands Bacon Factory Board by 10 cents per lb., equivalent to Sh. 15 per baconer which should help to arrest the fall in production.

(*Note.*—The Kenya European and Asian Agricultural Census, 1958, prepared by the East African Statistical Department, gives in great detail the economic analysis of European and African farms. That for 1959 will be published shortly.)

The Egerton Agricultural College, assisted by Government, continued its farm management surveys in Njoro, Trans Nzoia, Uasin Gishu, Molo and Mau Narok. The first report* on 18 farms at Njoro was produced towards the end of the year. The burden of it was that it was doubtful if farms of less than 800 acres were an economic proposition in the Njoro area at existing price levels using the present methods of farming. If the farmer was renting the farm, then it was probable that more than 800 acres were required. While output per acre was higher on small farms, costs were proportionately higher. The more profitable farms had a higher proportion of their land in wheat and sold whole milk rather than butterfat. Expenditure on good seed and fertilizer and on good feeding were associated with high crop and livestock yields and profits. Livestock farming seemed a safer method of ensuring some profits. Surveys of this nature will be of great importance to land control authorities proposed under Sessional Paper No. 10 of 1959/60 in determining sound land use. They will be continued and expanded to include African areas when the Department's two farm management economists arrive in 1960.

* Farm Profits and Costs, Njoro Area, 1958/59, by B. R. Davidson and W. J. England, Egerton Agricultural College Economics Survey Bulletin No. 1, 1959.

The publication of Dr. John Raeburn's results of his 1958 investigation into the ecomomics of different African farming systems is awaited with interest. Preliminary information fully supports the Department's programme of vigorous cash crop development in raising the standard of living and of providing employment for Africans in their own areas.

Plantation and Cash Crop Industries

To the very significant contributions which Government has made to African farming through land consolidation, provision of security of title to land, through research and advisory services, through improved water supplies, livestock and credit facilities must be added the increased tempo of cash crop development for which reasonable market outlets can be expected. Bigger expansion in the acreages planted to coffee, tea and pyrethrum took place than in any previous year. In the case of coffee, 5,800 acres were planted and the estimated African crop currently being sold, having an export value of £1,900,000, from earlier plantings is 4,785 tons out of the total estimated 1959/60 Colony crop of 23,600 tons and compared with 2,271 tons out of 23,356 tons in 1958/59. The first 18,039 tons sold realized an average of £419 per ton compared with £402 per ton for an equivalent quantity in 1958/59 compared with declines shown in other world growths, showing that the quality of coffee produced in Kenya was in short supply.

Kenya was again represented at international discussions in Washington in September. While the United Kingdom on behalf of the East African territories did not enter the coffee pact initiated by Latin American producers to set up export quotas, it signed a "declaration of intent" to co-operate in the new agreements and in an immediate and thorough examination of the world coffee situation by producing and consuming countries. Meanwhile, with the support of coffee growers, Kenya is holding its lower classes of coffee off the world market and is selling them locally at a cheap price and some financial sacrifice in order to expand consumption in the internal market and to remove competition with lower quality Brazilian coffees and with Robustas.

Coffee of the quality produced by Kenya was in short supply in world markets and it is very necessary to continue the expansion of the crop, not only to meet the strong demand but to meet the ambitions of 1,600,000 Africans (200,000 families) in the coffee belt to raise their standards of living above subsistence level. The acreage of plantation crop is also expanding steadily due to firm prices for Kenya coffee when prices of other coffee growths were on the decline, due to increased investment in flood water storage and irrigation and due to revival of coffee growing in western Kenya now that the control of coffee berry disease is possible.

The number of African coffee growers has increased from 15,019 in 1953 to 89,153 in 1959 and the acreage under African coffee from 3,867 to 26,161. It was to maintain this momentum with such a large acreage and number of growers that the shortage of field staff was seriously felt. At the time of writing, the percentage of coffee falling into the first three classes in the main producing districts showed Meru with 58.00 per cent compared with 56.10 per cent in 1958/59, Embu 73.98 per cent with 63.80 per cent, Nyeri 58.48 per cent with 25.59 per cent, South Nyanza 36.08 per cent with 35.53 per cent, Elgon Nyanza 29.26 per cent with 38.47 per cent, Fort Hall 56.48 per cent with 53.74 per cent and Machakos 73.77 per cent compared with 76.14 per cent in 1958/59.

The coffee industry appointed a committee to investigate the future organization of coffee research and accepted the Henn Report which recommended that the *ad valorem* levy on coffee be raised by one-half per cent so that one per cent, or £100,000 a year at present prices be devoted to supplementing the Government

expenditure on coffee research, that a research reserve fund be established to tide over any future recession and £100,000 was placed in this fund which was to be supplemented by unspent research balances, that Government should continue to hold the research stations and operate the research services but that the industry should have a closer say in the direction of research.

The tea crop rose from 25,179,164 lb. to 27,866,845 lb., the value of the tea sold in 1959, overseas and locally, being £4,850,995 and the area planted on estates from 32,300 to 34,651 acres. Estates continued to develop their potential and, with the large area of good tea-growing lands lying in African areas, in the long term tea may well become Kenya's most valuable crop. Great attention was given during the year to plans for accelerating tea growing by Africans, mainly with a view to securing the finance and supervision for the very costly field development and the provision of factories as acreages under tea warrant it where African tea potential does not lie in proximity to tea estates which have been willing to enter into agreement to purchase the green leaf. That this has become possible has been due to the Government investment in the Ragati tea scheme and factory on Mount Kenya which has removed the doubts as to the ability of peasants to grow tea when properly instructed, to securing high standards of plucking, to applying collecting and accounting methods for the sale of green leaf at buying centres and to transporting the leaf to the factory in good condition. Tea from the Ragati factory has been fetching amongst the highest prices in Kenya and all the staff concerned with this unique development deserve the highest commendation. With this experience the Colonial Development Corporation and a number of tea companies have shown great interest in participating in future development and during the year joined with Government in a working party to investigate ways and means of doing so. The fruits of these discussions will be seen in 1960. In Nyanza, green leaf sales of African-grown tea commenced in both Kericho and in Kisii to tea estates who were able to pay excellent prices, partly, due to the firmness of tea prices at the end of the year. Acreages now planted to African tea are 1,217 acres in Central Province, 297 acres in Nyanza and 27 acres in Nandi.

The price of sisal rose steadily and significantly during the year from £79 per ton for No. 1 grade to around £100 per ton due to world shortages and a good summer harvest in the northern hemisphere. This was very welcome to the Kenya sisal industry which had been working on a very small profit margin for some years and it is greatly to its credit that, despite a dry year, it was able to take advantage of the situation by raising production from 46,025 to 55,181 tons, an expansion little short of that which it had taken the previous four years to achieve. The sisal industry makes more beneficial use of marginal lands in terms of cash per acre and employment than any of the other alternatives, for instance beef ranching. The local usage of sisal by the bag and cordage factory at Ruiru has been a valuable adjunct to the industry and it is also producing very attractive and hard-wearing colour-fast sisal mats for which there is an internal and export market.

Increasing appreciation of the special insecticidal properties of pyrethrum accompanied by an expanded sales promotion programme has appreciably increased the demand for pyrethrum extract and it was unfortunate that in 1959 the expansion in production planned by the Pyrethrum Board should be affected by weather conditions. While production of pyrethrum flowers amounted to 4,846.5 tons compared with 3,823 tons in 1958, it is significant that a surplus of some 1,500 carried forward by the Pyrethrum Board at the end of June, 1958, has been eliminated and the Board could probably have sold 1,000 tons more in the current pool year than was likely to be available to it. This is being remedied and it is thought that as much as 10,000 tons of flower-equivalent of extract could be sold in the pool year 1961 62 which current planting plans must consider.

Before the war, processing of pyrethrum flowers was largely undertaken in the United States. When during the war processing was established in Kenya, the processing plants in the United States were largely eliminated. Before the war the American processors maintained their own inventories against periods of flower shortage or peak demand. During and after the war the United Kingdom and United States Governments established strategic stockpiles of insecticide which have been reduced steadily until the last of the United States stockpile will be run down in 1960. This has acted as a buffer for the Kenya Pyrethrum industry but now full responsibility rests on the industry not only not to oversell against variable crop estimates but to hold an adequate inventory of extract against crop failures and against seasonal and peak demands. This was stressed to me by the principal American buyers who are major consumers of Kenya's pyrethrum when I met them jointly in New York in December. That they were warm friends of Kenya was very evident but they stressed Kenya's special responsibility in this matter.

While African pyrethrum production still lags behind allocated quotas, it is hoped that African participation in the industry can now expand more rapidly, perhaps to 1,500 tons in 1960/61 and 2,400 tons in 1961/62. This position has been reached by completion of land consolidation in Kiambu, necessitating replanting large areas, by increased interest in Elgeyo and by a complete *volte face* in the Kisii Highlands where apathy towards the crop over many years was transformed into a vigorous planting programme which in fact reached the alarming proportion of 8,000 acres, alarming because if an extreme of overproduction with demoralizing effects on the participants is to be avoided, regulated expansion of the industry will serve the interests of producers best, particularly the African. Here again closer supervision is desirable. Tea will be developed in the area to spread the risk. Because of the good and stable market prices, other countries are showing increased interest in pyrethrum growing, including Ethiopia, the Congo, Tanganyika, Pakistan, certain South American countries and the old Japanese interest. However, Kenya with its very large areas suitable for pyrethrum growing is very well placed to meet increased competition, particularly on the price front.

Of the smaller cash crops not already mentioned, pineapple production did not fully meet the needs of the canners, partly because in the African district of Kiambu the suitable areas substantially overlap coffee which is more remunerative per acre. The wattle market continued in a depressed state and, while effective reorganization of inspection took place on the Plateau, African wattle production is likely to decrease still further as a result of land consolidation and more intensive use of the land. While fire-cured tobacco at Sagana, lower Embu and Kitui maintained its production, promising trials with Turkish tobacco continued.

Agricultural Education

There have been two significant developments in this field during 1959. The first of these has been the allocation of funds to develop the Siriba Agricultural College near Kisumu to Diploma level, through the generosity of the Rockefeller Foundation and the Hindocha Trust Fund, matched by contributions from Kenya development funds. This followed on a review of the Department's educational needs from which it emerged that 20 to 25 new staff with the Diploma in Agriculture were needed annually to replace wastage in their grade. It is essential that Africans play an increasingly important part in agricultural extension and education, and the cessation of the Makerere Diploma course has necessitated this development at Siriba. Because of the lack of warning, the proposed college will not produce Diplomates until 1965, and the aim is to produce a practical man who can be of real help to the practical farmer.

The year has also seen the opening of farmers' training centres at Bukura and Kabianga in Nyanza, the completion of another at Kisii. Three are operating in Central Province, and in Rift Valley Kaimosi has been at work throughout the year. Two others are planned in Southern Province, one to be built at Machakos and the other at Kitui for which the Nuffield Foundation has made a generous grant for the training of African families in health and better living as well as in agriculture. When all these farmers' training centres are fully developed it will be possible to have 200 farmers at a time in short courses, or 5,000 a year. These farmers' training centres have a vital part to play in improving farming methods after land consolidation and in educating teachers, chiefs and other key personnel in the importance of agriculture to Kenya.

The Department has benefited again from American assistance through the International Co-operation Administration and the Rockefeller Foundation. I spent three months in the United States studying the educational and experimental facilities, the services and financial support provided to farming by the Federal and State Governments and the land grant colleges and the range of farming systems, so varied and so akin to those of Kenya. Messrs. M. N. Harrison and A. W. Peers were enabled to study maize breeding and extension methods and Mr. H. C. Thorpe further to expand his study of wheat breeding. Other such courses are planned and in Washington I discussed plans to send a number of our trained African staff who would be capable of benefiting from such courses to study agricultural education and extension work whereby they may have an increasingly significant influence on future agricultural development.

Irrigation

The development of the black soils of Mwea-Tebere irrigation scheme under rice has brought out its economic potential and tenants have averaged a net income, after paying all dues, of £107. At Perkerra the Tugen tenants have had difficulty in settling down to intensive irrigation practice while it has been necessary to reorganize the farming system to place greater emphasis on a cash crop, onions, and irrigated pastures. It will take three years to prove and improve on this system. At Galole on the Tana River, cotton showed some promise under irrigation. While some irrigation of sugar-cane by Asian farmers on the Northern edge of the Kano Plains in Nyanza Province is expanding, lack of funds has prevented development of the main area of the Kano Plains where the biggest potential for profitable irrigation of rice and sugar-cane lies. However, preliminary experimentation is desirable and progress was made with the establishment of the irrigation research station there while those at Mwea, Perkerra and Galole are undertaking useful studies for the future guidance of these projects.

Research

The research advisory committees played an important part during the year. Besides the Central Agricultural and Veterinary Research Advisory Committee, there are advisory communities for coffee, sisal, pyrethrum, cereals, grasslands and horticultural research and farm advisory committees for the experimental and husbandry farms at Ol Joro Orok, Eldoret, Kitale, Sotik, Molo, Marindas and Thika. These committees, the many field days that are organized on stations and the use of the many farming and commodity journals in Kenya, assisted by the advisory services kept a good output of knowledge and advice flowing out to farmers during 1959. Progress with research work is reported on at Part II of this volume but will be published in greater detail in a form suitable for the research worker and future record in Volume II, Record of Investigations, at a later date. The publicity given to research results is indicated by the list of publications in Part IV of this report.

Particular attention is drawn to the threat of soil-borne diseases such as eelworm and potato wilt to future crop production, which is insufficiently realized in the consideration of land tenure problems where the farmer on a subeconomic unit will lack the latitude provided by rotation to move away from infected land and rest it under grass for a period.

A number of American technical assistance schemes were completed during the year and provided excellent examples of how in a year or two it is possible to complete a study of finite problems to which a serving officer cannot generally be diverted from the press of other duties. Dr. James Thorp, and his soil survey team assisted by the chemical studies and new techniques of Dr. Adolf Mehlich, all of I.C.A., completed their planned programme during the year, although it is hoped that Dr. Mehlich will return. They covered 230,000 acres in Nyanza in their survey of soils suitable for sugar-cane growing besides 20,000 acres in Sotik, a survey of lands with irrigation potential in the northern Uaso Nyiro catchment and the delimitation of a tea development area in the Nyambeni Hills of Meru District. Their reports on the surveys, survey techniques and soil examination procedures will be published shortly and they have imparted their skills to our own staff who remain behind. Valuable assistance is being provided by the Director of Overseas Surveys in printing the maps for these and the Fulbright reports and in having posted their Land Use Officer, Mr. Martin Brunt, to Kenya to produce a land use map of the lands of high potential in association with the East African Agriculture and Forestry Research Organization ecologist, a Kenya pasture research officer and departmental field staff.

Two Fulbright scholars were in Kenya during part of 1959, Dr. James Moomaw who completed a valuable ecological survey in Coast Province, and Dr. Harold C. Heady, Professor of Forestry at the University of California, who made a survey of range land categories which will provide a comprehensive guide to range management in Kenya and other East African territories for years to come. His particular recommendation was that investigations into range-land problems was too dispersed between departments and over the country and should be operated from a single main station with a widely experienced ecologist at the head. Certainly invasion of useless bush into ranching and pastoral areas gives increasing cause for concern and it is imperative that economic means be found of getting rid of it.

That the American teams have worked in so happily with the Agricultural Department research workers and that liaison with I.C.A. headquarters has worked smoothly, is a measure of the fine personality of the technical leader of the team, Mr. Charles Enlow who also completed his tour of duty in Kenya.

The valuable investment of the major crop industries in research has been mentioned but to this must be added the contributions from the Colonial Development and Welfare Fund to specific research projects, including wheat and maize breeding and pathology, coffee berry disease and Hemileia leaf rust, tractor and implement testing, taxonomic work on the Coccidae, the publication of the technical reports mentioned above, the provision of two farm management economists, at present in training, and the preparation of reports by Mr. R. W. Rayner on coffee pathology and physiology after his retirement. The pyrethrum industry too has benefited from work in the United Kingdom financed partly from Colonial Development and Welfare funds allocated to the Tropical Products Institute and from United Kingdom Agricultural Research Council funds to Rothamsted which will bring important new knowledge to bear in the fields of chemical analysis, utilization and plant breeding.

Weather

The year started off well but the main crop season was affected by droughty conditions in many areas during the normal Long Rains Season except at the Coast. In January most of Kenya except for the Northern Province experienced normal dry weather until the last week of the month when there were fairly widespread thunderstorms. Cloudier conditions continued into February with widespread rain mostly of light intensity except in Nyanza where heavier falls were experienced.

The first half of March was generally dry, but the rains started in most areas about the 19th and from then until the 27th heavy falls were recorded in many areas the heaviest again being in Nyanza. A dry spell intervened over the last few days of March and the first week of April; rainfall became more widespread again during the last three weeks of April but was very "patchy", some very heavy falls were recorded at the Coast while over most of the Highlands totals were well below average.

The heavy rain on the Coast continued during the first week of May, and was followed by much drier conditions. Over inland areas afternoon showers and thunderstroms of varying intensity produced the expected May rainfall in most places although there were deficiencies in the west and near Mount Kenya. The first half of June was dry in all areas; fairly widespread showers later in the month broke the drought over the Coast and the Rift Valley, but several places east of the Aberdares had a completely dry June, Fairly frequent showers continued throughout July along the Coast, but inland afternoon showers were more isolated than normal and most rainfall totals were below average. August followed a similar pattern, while September and October the Coastal weather became very dry and the drought in some areas east of the Aberdares began to affect seriously farms and coffee plantations. Over the Rift Valley and western areas rainfall was about average in September and October.

Dry conditions continued on the Coast in November, but over the Highlands rainfall totals were double the previous averages in many places. There was a marked decrease in showers over all inland areas during December, especially in the north where the Seasonal dry conditions became well established. Some heavy rain about mid-December broke the drought over the South Coast but no rain was recorded over the North Coast.

At the Coast the crop season was very good whereas in Southern Province a very dry year was experienced. Some areas in Kitui District had no rain at all until November. The Kangundo location of Machakos District recorded no rainfall from June to November whereupon 16.74 inches fell in 17 days followed by December's total of 1.70 inches in two days.

Nyanza Province was particularly affected by the dry weather in the middle of the year which caused crop failures in the low areas around the Kavirondo Gulf. Hail was prevalent in North Nyanza in May.

Some heavy hail storms were reported from the Lugari and Turbo areas of the Rift Valley causing damage to maize crops. The maize crop generally in this Province, however, recovered well from the mid-year drought.

In the Central Province the Long Rains were poor in Kiambu and Fort Hall. The period between May and October was one of the driest recorded in the southern part of the Province which was followed by exceptionally heavy Short Rains in Kiambu.

(This section and Table A has been compiled mainly from notes provided by the Director of the East African Meteorological Department.)

TABLE A.—SOME FIGURES OF RAINFALL IN THE AGRICULTURAL AREAS OF KENYA, 1959

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Kwala Agric. Dept.	Total	1·51	0·17	0·08	11·17	5·56	2·86	4·94	8·77	1·40	1·18	1·48	6·64	45·76
	%	116	22	3	186	59	76	160	391	54	35	40	211	109
Ruiru Jacaranda	Total	1·30	0·21	3·43	3·98	8·69	0·07	1·26	0·68	0·70	0·48	10·01	2·86	33·67
	%	69	12	106	41	127	3	130	59	47	19	212	96	86
Kakamega D.C.	Total	2·56	4·58	8·20	9·56	6·35	4·36	7·12	4·31	6·55	10·14	6·93	2·60	73·26
	%	116	129	150	99	60	57	103	48	93	221	187	79	99
Kitale, O. H. Knight	Total	0·61	3·31	0·74	2·83	5·23	1·73	4·42	2·43	1·72	2·49	3·02	0·10	28·63
	%	74	352	32	50	91	40	77	40	52	84	142	11	70
Thomson's Falls K.C.C. Ltd.	Total	1·13	1·40	2·16	2·66	5·25	1·49	5·73	4·30	3·00	0·58	4·37	2·09	34·16
	%	97	97	109	61	147	40	103	68	115	43	169	86	92
Nyeri, Mweiga	Total	1·62	1·36	0·83	7·03	2·59	0·97	1·55	1·15	0·50	2·28	4·36	2·12	26·36
	%	75	87	29	122	55	77	98	71	49	87	111	60	81
Njoro Plant Breeding Station	Total	1·94	1·08	2·97	2·97	8·38	2·73	3·75	1·54	3·64	1·35	3·57	0·84	34·71
	%	188	80	111	58	185	81	83	31	139	68	138	45	95
Naivasha Vet. Station	Total	1·15	1/03	2·73	3·10	5·16	2·77	1·10	2·27	2·52	0·41	4·17	0·80	27·21
	%	91	82	128	66	132	125	59	113	132	19	169	53	99
Kapsabet D.C.	Total	0·72	2·90	6·46	3·60	5·67	2·03	3·99	3·80	7·48	5·98	6·35	1·28	50·26
	%	35	100	146	47	66	32	60	48	130	174	219	60	83
Molo Railway Station	Total	2·24	0·41	4·38	4·59	5·38	2·27	4·43	4·75	2·93	3·16	5·43	2·46	42·43
	%	172	22	118	66	98	47	81	68	77	133	165	98	87
Lumbwa Mtarogon	Total	2·27	3·30	3·55	4·66	5·32	1·63	4·95	5·23	5·55	4·43	5·98	1·43	48·28
	%	135	134	90	64	80	33	89	85	139	178	221	63	96

Food Production in African Areas

In Nyanza Province in spite of a difficult season sales of produce have been good. The Kano Plains and the Lake Shore area of South Nyanza experienced almost a total failure of the maize crop. Marked improvement in crop husbandry and in particular the use of manure have helped in some measure to offset the effects of the patchy season. In the Rift Valley Province good yields of maize and other food crops were obtained in the African districts there being a surplus of maize in Nandi District which was sold out of that District.

In Central Province generally poor rainfall in the early part of the year resulted in fears of food shortages in most areas. In Southern Province maize was in short supply and importations were required although production from the hill areas kept the Machakos District going until September. Food crops in some areas of the Coast Province suffered from badly distributed rainfall but good results from cash crops will relieve any hardship that may arise early in 1960.

Agricultural Exports

The total value of agricultural exports increased from £26,320,584 in 1958 to £29,648,472 in 1959.

Exports of the following commodities exceed £500,000.

	Position in 1958	*1958* £	*1959* £
1. Coffee	(1)	10,422,722	10,593,790
2. Tea	(2)	3,216,977	3,601,643
3. Sisal	(3)	2,227,997	3,458,472
4. Pyrethrum (inc. Extract)	(5)	1,814,085	2,196,268
5. Hides and Skins ..	(7)	1,017,799	1,608,930
6. Wattle	(6)	1,024,166	1,224,085
7. Maize	(4)	1,867,061	1,123,270
8. Meat Products	—	377,420	1,044,998
9. Butter	(8)	945,681	710,610
10. Cotton	(10)	514,846	658,264

Crops

Cashew Nuts.—The season was a good one. Five exporters were licensed and the price to the producer ranged from 36 cents down to 22 cents per pound. The total crop was 2,877 tons and the approximate value to the producer on an average price of 26 cents was £84,000. The 1959/60 buying season opened on 1st December with high average prices up to 50 cents per lb. The estimated yield is 3,000 tons. Seven exporters have been licensed.

Cassava.—This is mainly grown in Kenya as a subsistence crop and in particular an insurance against famine. The crop normally receives the minimum of attention. The acreage is increasing in some areas notably Southern Province and the West Suk District of Rift Valley Province. The crop is notably popular in the Kwale District of Coast Province.

Castor Seed.—Dry weather affected the main producing area Kitui District during the year. Production amounted to only 1,077 tons worth £40,263 for the whole Southern Province compared with 1,577 tons worth £64,618 for Coast Province, but of this latter only some 480 tons were marketed.

Crops (*Scheduled, section* 109 *Agricultural Ordinance,* 1955)

Production estimates for the 1959 Crops from Scheduled Areas are:—

	Acreage	*Average yield Bags per acre*	*Total yield Bags*
Wheat	251,631	.. 5.45 ..	1,371,670
Maize (White)	84,988	.. 8.61 ..	732,411
Maize (Yellow)	27,739	.. 8.29 ..	230,066
Barley	44,075	.. 8.67 ..	382,511
Oats	20,789	.. 8.67 ..	180,336
Sunflower	11,201	.. 4.55 ..	50,998

For comparison, actual production figures for 1958 crops were:—

	Acreage	*Average yield Bags per acre*	*Total yield Bags*
Wheat	235,223	.. 4.58 ..	1,077,383
Maize	124,374	.. 9.37 ..	1,165,569
Barley	56,050	.. 6.70 ..	375,835
Oats	21,134	.. 6.86 ..	145,010
Sunflower	12,338	.. 4.97 ..	61,328

The African grown maize crop in Nyanza Province resulted in purchases by the Nyanza Province Marketing Board of 671,340 bags. Production in Central Province amounted to 158,161 bags. Estimated purchases for the 1959/60 crop are Nyanza 660,000 bags and Central 110,000 bags.

The guaranteed f.o.r. price for Grade II maize from the 1959 crop was Sh. 37/90 per 200 lb. in a new bag f.o.r. senders station.

As in previous years the price was published naked; this amounted to a reduction of Sh. 1/50 per bag in the price of maize required for internal consumption. The price for Grade I wheat was Sh. 50 per 200-lb. bag naked. For the other scheduled crops minimum prices were fixed as follows:—

Barley	180 lb. net in bag ..	Sh. 20
Oats	150 lb. net in bag ..	Sh. 15 00
Sunflower	100 lb. net in bag ..	Sh. 13 50

Owing to negligible production and poor yields linseed was withdrawn from the Schedule.

Cereals, Other.—Production of millets and sorghum was maintained in Nyanza Province and purchases by the Marketing Board amounted to over 50,000 bags of millet (*Wimbi*) and over 23,000 bags of sorghum. Small quantities were also handled in Central Province.

Chillies.—Production has again declined in Coast Province. Price was the main factor, growers considered that Sh. 17 to Sh. 20 per frasila was not worth the effort. Taita District exported 114 tons worth £11,565, Kwale 20 tons worth £2,240, Kilifi 11 tons worth £1,500.

Coffee.—Total Colony production from the 1958/59 crop amounted to 23,266 tons compared with the previous crop of 20,837 tons. The crop was valued at £9,150,734 with an average payout of Sh. 393/31 per cwt. The area planted by European growers is approximately 67,000 acres. Particulars of the African-grown crop are given in Table B.

TABLE B.—PARTICULARS OF AFRICAN-GROWN COFFEE AS AT 31-12-59

District	Total Planted Acreage	Production in 1959		Value to Grower	No. of Growers	No. of Nurseries	No. of Seedlings in Nurseries	No. of Factories	No. of Co-op. Societies
		Tons		£					
		Clean	*Mbuni*						
ARABICA—									
S. Nyanza	3,800	434	693	269,300	14,081	30	610,000	22	30
Elgon Nyanza	2,190	148	37	62,677	8,525	17	372,138	13	15
North Nyanza	417	18	9	8,500	2,823	6	67,032	2	8
Central Nyanza	25	Nil	Nil	Nil	243	3	83,000	Nil	2
Kericho	74	Nil	Nil	500	262	3	60,000	Nil	1
ROBUSTA—									
Elgon Nyanza	74	Nil	Nil	Nil	375	2	14,978	Nil	2
North Nyanza	40	Nil	Nil	Nil	481	1	5,000	Nil	1
Central Nyanza	33	Nil	Nil	Nil	326	3	37,000	Nil	2
ARABICA—									
Taita Hills	395	27	28	6,233	1,773	1	120,000	1	1
Machakos	933	90	28	43,515	4,983	15	235,000	3	7
Meru	8,066	1,800	480	862,000	25,000	46	650,000	46	13
Embu	4,638	1,300	392	640,000	13,947	16	896,010	23	11
Nyeri	2,275	344	134	157,899	6,927	13	305,767	8	4
Fort Hall	1,911	179	76	86,803	6,169	18	364,449	11	11
Kiambu	1,290	79	88	43,262	3,238	21	793,699	6	6
TOTALS ..	26,161	4,419	1,970	2,180,738	89,153	195	4,614,073	135	114

In Central Province climatic conditions in the early part of the year were generally unfavourable for ripening of a good crop and the after crop recovery of the trees. This was particularly apparent in Meru where dry conditions and a heavy harvest resulted in leaf fall and symptoms of nutritional deficiencies. Coffee Berry disease continues to cause losses in the Province particularly in Nyeri and Fort Hall. There was some difficulty over maintaining standards of cultivation during the year particularly in the Kikuyu Districts and Meru but the augmentation of the Advisory Services has largely overcome this. The quality of the crop remained high particularly in the larger producing areas of Meru and Embu.

In South Nyanza the quality of coffee improved enormously in spite of difficulties in some nurseries due to bad management and a lack of appreciation of technical requirements in the Coffee Union. Drought affected quality in Elgon Nyanza and serious infestations of *Hemileia Vastatrix* were recorded. Heartening progress was made in Machakos District where the acreage is nearing 1,000 acres, quality was maintained and the coffee kept in good condition by keen attention to cultural requirements (pruning, mulching and manuring) in spite of a very dry season. Good quality coffee was also produced in the Taita Hills at Wundyani.

The Kenya Coffee Board Cup went to Embu District being won by the Mutira Society.

Coconuts.—The acreage under coconuts has increased by some 1,000 acres over the Coastal Districts. The average yield per palm in many parts of the Province is only 15 nuts per annum and in the best areas 25 to 30 nuts per palm. A high percentage of palms are unproductive. The local demand for copra exceeds the supply and imports of both oil and copra are considerable.

Cotton.—The final production figures for the 1958 cotton crop which was ginned early in 1959, totalled 17,378 bales. Owing to the depressed state of the world market prices were adversely affected. The average prices realized for AR lint were 174.46 cents per lb. for Nyanza Cotton and 179.66 cents per lb. for Coast grown cotton.

Particulars of the 1958/59 crop are given below:—

		Bales of Lint of 400 lb.			
	Acres	*AR*	*BR*	*Total*
Nyanza Province ..	80,924	11,719	1,255	12,974
Coast Province ..	31,638	3,663	741	4,404
	112,562	15,383	1,996	17,378

The price paid to growers for AR lint was 46 cents per lb. in Nyanza Province and 48 cents per lb. at the Coast. BR prices were 18 cents in both Provinces.

The estimate for the 1959-planted crop is 17,300 bales of which 11,500 bales are from Nyanza and 5,800 bales from the Coast. Buying at the Coast commenced on 23rd November and in Nyanza on 30th November. Prices to growers for this crop are AR 47 cents per lb. and BR 18 cents per lb. in both Provinces.

Essential Oils.—The North Lumbwa farms growing geraniums were badly hit by drought. As a result the expansion in acreage which had been anticipated did not occur. There are 150 acres under crop in this area and a similar acreage in the Nakuru District. Export figures are in Table C.

Groundnuts.—The main producing area in South Nyanza was affected by drought and only 112,805 bags worth £46,316 were sold in 1959. Poor yields were obtained in Machakos District due to weather conditions from the trial plantings reported last year.

Kapok.—Coast production in 1959 amounted to 70 tons valued at £1,883.

Maize.—*See* Crops, scheduled.

Passion Fruit.—The Sotik factory serves four growers. A total of 1,795 gallons were processed of which 1,552 gallons were for export and 243 gallons went to the local market. The Passion Fruit Board was wound up during the year, production being inadequate to sustain a statutory board. In the Machakos District sales of passion fruit realized £940 from exports to Nairobi and a Thika Cannery. Two tons were sent by air to London realising a price of 30 cents per lb. to the producer. An increased acreage is planned in the District.

Pineapples.—Sales of pineapples from the Central Province decreased from £71,806 in 1958 to £51,188 in 1959 as a result of a reduced production of 6,212 tons compared with 8,549 tons in 1958. Most of this production comes from Kiambu District, 6,069 tons, with small quantities from Embu, 68 tons, and Fort Hall, 75 tons. Much advisory attention has been given to this crop in an endeavour to arrest the decline in production. However, in the Gatundu Division of Kiambu, where all the pineapple growing is in the coffee zone, pineapples fail to gain much interest. Sales to canneries amounted to 10,981 tons, of which 5,028 tons were European produced and 5,953 tons African produced.

Potatoes.—Production in Central Province was 94,798 bags valued at £88,076 the main producing areas being Meru 51,527 bags and Kiambu 36,500 bags. The acreage in this Province continues to increase but much of the increased production goes to local consumption within the Province and is not reflected in figures of exports out of the Province. Approximately 2,000 acres are grown in European farms mainly in Nakuru and Naivasha Districts. The most widely grown variety is Dutch Robijyn.

Pulses.—Recorded sales in Provinces are given in Table D and exports in Table C.

Pyrethrum.—Production of dried flowers was 4,846.5 tons in 1959. The licensed acreage is 28,884 acres and the number of growers 938. In addition 20 African co-operative societies are licensed. In Central Province the planted acreage has increased from 2,726 acres in 1958 to 3,684 acres in 1959 of which 3,090 acres is in Kiambu. In Nyanza Province the crop has gone ahead to the extent that a mid-year census revealed a total of 11,500 growers and 5,230 acres planted in South Nyanza. The acreage in the Elgeyo District of Rift Valley Province has risen to 230.

Rice.—Production in Nyanza declined from 57,191 bags valued at £103,135 in 1958 to 33,202 bags valued at £59,975 in 1959. Production in the Central Province on the Mwea-Tebere irrigation scheme increased significantly and amounted to 23,439 bags of 160 lb. paddy.

Sisal.—Production in 1959 amounted to 55,181 tons as compared with 46,025 tons in 1958. This is a result of improved prices. This crop was worth £65,386 to Machakos District and the sisal scheme purchased 463.3 tons of fibre from traders at 27 cents per lb. delivered.

Sugar.—Production figures for Kenya factories in 1959 were 19,015 tons at Miwani and 8,195 tons at Ramisi totalling 27,210 tons compared with 27,877 tons in 1958. The Miwani Mills crushed 206,987 tons of cane of which 32,166 tons were supplied by smallholders. The price paid to smallholders for cane was Sh. 42/78 per ton. Asian sugar growers in the Kibos area produced 4,750 tons of Jaggery.

Throughout Nyanza Province generally sugar yields have been reduced by the drought. In South Nyanza the three jaggery factories at Utoma, Mirogi and Ongeng were financed from 1st January by the newly formed Nyanza Province African Grown Sugar Board. In Central Nyanza there are now 80 acres of African grown cane near Chemelil but in North Nyanza the Shiamberere factory was not working to full capacity growers being averse to cutting mature cane. A factory at Mumias closed and the Butere factory only worked intermittently. The mobile jaggery factory continued to operate in North Nyanza and in Elgon Nyanza two privately operated mills produced good jaggery.

Tea.—The licensed acreage now amounts to 72,728 acres of which 34,651 acres has been planted. Production in 1959 totalled 27,866,845 lb. an increase of 698,732 lb. on 1958. Of this production the Kericho District was responsible for 21,452,839 lb. and the African Tea Scheme at Ragati in Nyeri District 182,108 lb.

In the Central Province 500 acres were planted bringing the total up to 1,217 acres by the end of the year. Production averaged 378 lb. of made tea per acre and the number of African growers was 3,805. The high quality of Ragati tea was maintained.

In Nyanza Province the total acreage under tea by African growers was 297 acres at the end of the year and the number of growers 621. The first pluckings in both Kericho and South Nyanza have yielded high quality leaf. In Nandi District 27 acres of tea has been established by African producers.

Tobacco.—Figures supplied by the East African Tobacco Company are:—

Area	*Leaf Purchased lb.*		*Value*
	Green	*Cured*	£
Kitui	820,918	58,053	10,543
Ena	1,309,712	—	5,768
Sagana	1,354,690	—	5,626
	3,485,320	58,053	21,937

Prices paid for Grades 1, 2 and 3 green leaf were 12, 8 and 3 cents per lb. respectively. For cured leaf Grade A Sh. 5/10 was paid grading down to 60 cents per lb. for scrap leaf.

It is estimated that some 500 acres were grown in Kitui during the year and 650 acres in Central Province.

Field scale plantings of Turkish tobacco have been made in Central, Southern and Coast Provinces during the year to gain experience with the crop under local conditions.

Vegetables, Fruit and Flowers.—Sales in the Central Province were:—

	Value £
Bananas—	
2,299 tons	46,222
Flowers, Fruit and Vegetables—	
9,897 tons	148,923
Miraa (*Catha edulis*)—	
190,654 bundles	54,063
Onions—	
282 tons	5,174
Total	£254,382

Figures for the Southern Province were:—

	Value £
Fruit and Vegetables—	
1,977.5 tons	90,443
Onions—	
95 bags	528
Mangoes—	
540,000 fruits	2,700

Production in the Taita Hills of Coast Province improved in 1959 amounting to 665 tons worth £13,300, banana production in Kwale District was worth £20,000 and in the Kilifi-Malindi area £101,600. Mango production in Malindi area was estimated to be worth £50,000 to producers. Marketing figures, however, were very much lower.

Wattle.—Production continued to decline in Central Province the main African producing area and amounted in 1959 to £20,574 tons worth £204,727 compared with 25,613 tons worth £251,357 in 1958. Extract production in 1959 amounted to 17,731 tons and of processed bark to 5,647 tons. Total exports and local sales of extract amounted to 19,263 tons. Export figures are given in Table C.

Wheat.—*See* Crops, Scheduled.

Livestock Products

Particulars of production from the African areas are given in Table D. Figures for the export of these products are given in Table C.

TABLE C.—QUANTITIES AND VALUES OF EXPORTS OF KENYA PRODUCTS, 1959

Commodities	Unit	Quantities					Values				
		1939	1956	1957	1958	1959	1939	1956	1957	1958	1959
Livestock Products							£	£	£	£	£
Beeswax	Cwt.	1,208	919	827	1,576	1,521	5,162	25,123	20,329	36,872	33,321
Butter and Ghee	,,	21,277	38,170	31,080	65,716	51,140	90,659	620,402	506,959	972,549	710,610
Cattle	Number	—	831	395	260	1,363	—	25,313	12,550	7,587	33,075
Cheese	Cwt.	652	1,166	758	749	6,858	2,987	16,994	11,500	10,675	82,344
Hides and Skins	,,	†	110,524	112,730	85,760	107,995	155,868	1,165,532	1,462,861	1,017,799	1,608,930
Meat—											
Bacon and Ham	,,	1,376	3,593	11,767	38,911	38,237	9,080	56,770	172,069	406,346	380,965
Beef and Veal	,,	—	—	—	—	63,454	—	—	—	—	482,919*
Mutton	,,	—	—	—	—	1,513	—	—	—	—	14,135*
Pork	,,	—	—	—	—	524	—	—	—	—	7,790*
Tinned	,,	—	—	—	—	59,803	—	—	—	—	1,044,998*
Sheep and Goats	Number	—	51	284	280	2,813	—	224	621	831	7,612
Wool	100 lb.	15,114	16,666	16,210	16,665	20,025	56,578	279,616	289,677	309,253	380,988
Other Livestock Products	—	—	—	—	—	—	—	—	—	—	82,118*
Crop Produce											
Cashew Nuts	Tons	32	1,891	1,714	1,745	1,911	1,812	144,162	114,898	108,792	100,659
Castor Seed	,,	—	3,453	4,325	6,932	3,946	—	206,686	271,733	311,894	177,660
Coconuts and Copra	,,	215	80	102	542	1,727	1,561	3,568	2,259	19,808	117,568
Coconut Oil	Cwt.	33,152	1,987	208	1,129	530	2,346	9,821	1,177	6,038	3,917
Coffee	,,	338,125	534,214	445,677	500,536	517,545	800,827	13,674,568	10,812,281	10,422,722	10,593,790
Cotton	100 lb.	59,677	69,045	31,097	49,294	70,567	124,021	852,474	369,722	514,846	658,264
Essential Oils	Cwt.	*gal. 3,660	730	1,051	717	516	4,956	29,731	32,687	20,107	19,369
Grain other than Maize and Wheat	,,	14,618	84,484	691	849	27,419	4,424	144,074	1,750	1,999	27,864
Groundnuts	Ton	402	1,760	2,039	1,427	2,041	4,442	107,755	146,172	95,414	119,297
Groundnut Oil	Cwt.	6,233	315	16	6	1	680	1,835	120	34	11
Maize	,,	1,007,125	84,706	452,177	1,956,644	1,086,300	222,037	89,403	466,062	1,867,061	1,092,144
Maize Meal and Flour	,,	122,029	479	368	11,248	25,380	25,450	817	714	22,263	31,126
Passion Fruit Juice	,,	22,744	—	*gal.* 4,088	*gal.* 3,240	*gal.* 2,062	6,713	—	3,253	2,156	1,609
Pineapples, Tinned	100 lb.	—	138,067	115,355	115,322	109,748	—	765,631	584,358	555,351	490,719
Potatoes	Cwt.	173,046	18,120	31,454	43,636	38,836	29,199	18,823	37,420	51,989	38,620
Pulses, including Beans and Peas	,,	130,758	5,983	8,635	63,592	156,553	42,952	18,677	23,590	129,384	321,154
Pyrethrum	,,	55,628	26,180	34,636	36,125	20,950	357,170	390,183	506,254	524,766	333,272
Pyrethrum Extract	,,	—	2,049	1,537	3,435	4,058	—	810,397	597,300	1,289,319	1,862,996

*Previously included in "other agricultural produce".

†Hides 40,982 cwt. Skins 1,351,625.

TABLE C.—QUANTITIES AND VALUES OF EXPORTS OF KENYA PRODUCTS, 1959—(*Contd.*)

Commodities	Unit	Quantities					Values				
		1939	1956	1957	1958	1959	1939	1956	1957	1958	1959
							£	£	£	£	£
Sesame Oil	Cwt.	89,944	89	171	412	17,173	10,008	565	1,249	2,673	52,805
Sisal	Ton	29,163	35,205	39,598	42,147	51,006	442,434	2,075,303	2,078,012	2,227,997	3,458,472
Sugar	Cwt.	81,463	311	791	350	680	50,308	993	2,538	1,160	1,747
Sunflower Seed	Ton	477	1,272	1,283	1,550	2,873	3,997	46,016	53,759	52,046	82,851
Tea	Cwt.	88,627	139,125	143,878	162,723	188,461	501,732	2,615,677	2,860,612	3,216,977	3,601,643
Wattle Bark	Cwt.	226,716	118,230	83,992	59,020	123,848	72,846	193,438	134,452	94,615	197,833
Wattle Extract	Ton	131,312	436,258	526,296	379,646	388,786	91,439	1,501,332	1,521,875	1,024,166	1,026,252
Wheat Flour	Cwt.	63,883	1,787	1,668	2,580	1,251	50,655	4,770	4,705	8,531	3,887
Other Agricultural Produce	—	—	—	—	—	—	55,649	281,448	340,830	986,544	363,858
						Total .. £	3,242,495	26,178,121	23,446,278	26,320,584	29,648,472

TABLE D.—QUANTITIES AND VALUES OF MORE IMPORTANT PRODUCTS MARKETED FROM THE AFRICAN AREAS (PARTLY ESTIMATED) EXCLUDING RIFT VALLEY AND NORTHERN PROVINCES

Produce	Unit	Nyanza Province		Central Province		Southern Province		Coast Province	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
			£		£		£		£
Bananas	Tons	—	11,412	2,299	46,222	—	—	1,635	25,188
Cashew Nuts	Tons	—	—	—	—	—	—	3,335½	119,780
Cassava	125 lb.	14,735	8,067	—	—	36	40	41,616	24,049
Chillies	Tons	—	—	—	—	—	—	144¼	15,305
Coffee (Parchment and Buni)	Tons	1,532½	341,026	4,287	1,789,964	118½	43,515	55	13,580
Copra	Tons	—	—	—	—	—	—	2,020	112,120
Coconuts	Number	—	—	—	—	—	—	18,589,150	140,621
Corriander	90 lb.	—	—	—	—	243	820	—	—
Castor Seed	180 lb.	745	1,784	2,472	5,129	13,342	40,263	6,032	19,546
Cotton Lint	400 lb.	12,974	308,724	—	—	—	—	4,405	156,677
Charcoal, Fuel, Poles	—	—	—	—	42,631	—	1,640	—	52,442
Groundnuts	180 lb.	12,805	46,316	—	—	—	—	—	—
Kapok	lb.	—	—	—	—	—	—	159,260	1,883
Maize and maize meal	200 lb.	669,382	800,429	158,161	163,184	3,882	9,468	24,929	34,109
Millets and Sorghums	200 lb.	92,525	102,766	10,578	9,088	3,255	8,270	2,412	5,500
Miraa (*Catha edulis*)	Bundles	—	—	190,654	54,063	—	—	—	—
Onions	180 lb.	777	1,554	3,454	5,174	95	528	—	—
Palm Wine	gals.	—	—	—	—	—	—	609,000	152,255
Potatoes (English)	180 lb.	8,542	7,638	94,798	88,076	2,613	1,800	—	—
Pulses	200 lb.	23,417	48,043	107,159	216,030	3,164	11,317	6,441	19,334
Pyrethrum	Tons	334	74,824	285	68,322	—	—	—	—
Rice (Paddy)	160 lb.	33,202	59,975	23,439	38,235	—	—	3,179	5,107
Pineapples	Tons	—	—	6,212	51,188	—	—	—	—
Sesame	180 lb.	7,505	32,030	—	—	—	—	6,280	27,553
Sisal	Tons	—	—	—	—	1,468	65,386	—	—
Sugar Cane	Tons	11,712	12,520	1,370	7,260	—	—	—	—

TABLE D.—QUANTITIES AND VALUES OF MORE IMPORTANT PRODUCTS MARKETED FROM THE AFRICAN AREAS (PARTLY ESTIMATED)—(*Contd.*)

Produce	Unit	Nyanza Province		Central Province		Southern Province		Coast Province	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
			£		£		£		£
Tea	lb.	65,537	1,465	182,632	27,789	—	—	—	—
Timber	Tons	—	—	1,118	27,950	—	—	—	—
Tobacco Flue Cured	lb.	—	—	2,658,628	11,395	—	—	—	—
Tobacco Native Cured ..	lb.	—	—	582,002 (Snuff)	17,548	—	—	112,000	5,600
Vegetables, Flowers and Fruit		—	—	—	148,923	—	90,443	*tons* 2,225	54,141
Wattle Bark	Tons	66	462	20,574	204,727	—	16,582	603	5,725
Wheat	200 lb.	208	473	329	1,697	—	—	—	—
Miscellaneous		—	434	—	—	—	5,062	—	6,790
Livestock Products									
Beeswax	36 lb.	—	—	—	—	1,939	8,475	—	125
Cattle	Head	—	—	—	—	23,128	140,273	25,127	301,524
Eggs	Number	2,092,464	13,804	260,616	3,410	496,939	4,433	—	—
Ghee	36 lb.	14,645	61,041	—	—	1,432	7,068	1,041	2,222
Goats and Sheep	Head	—	—	832	1,248	18,456	18,456	30,782	30,782
Hides	Number	—	358,374	36,865	41,621	60,009	43,291	20,505	18,199
Milk and Cream		—	2,750	—	12,512	—	—	—	10,775
Pigs (Porkers)	Head	—	—	2,366	10,142	—	—	—	—
Poultry	Head	2,123	531	27,277	4,265	150,087	31,588	14,050	3,095
Skins	Score	21,446	110,535	10,420	40,327	11,957	59,422	6,139	14,128
Total Value, 1959 ..			£2,406,977		£3,138,120		£608,140		£1,378,155
Total Value, 1958 ..			£1,997,331		£2,580,565		£575,695		£537,432

PART II—RESEARCH AND SPECIALIST SERVICES

1959 has been a difficult year because of staff shortages in the Research Division but it has been a year of solid achievement over a wide field of activities.

Results of the utmost value to the coffee industry continue to accrue from the work of the Coffee Research Station and the special research team working on the problems of Coffee Berry Disease and Coffee Leaf Rust. The investigations into the problem of Stem Pitting have been placed on a sound footing and progress is being made. The expansion of facilities and staff made possible under financial provision from the Coffee Board of Kenya is already paying dividends and this industry is to be congratulated on its decision at its Annual Conference to implement the recommendations of the Henn Committee on research.

The Plant Pathology Section at the Scott Agricultural Laboratories has initiated valuable work on seed dressings with a wide range of crops and plans have been made for intensive work on the eelworm problem which is considered to be one of the most serious which faces the agricultural industry. It has also proved possible to continue the expansion of research in the field of legume bacteriology. Good progress can be reported on the control of pests of cotton and of stored products, particularly in the difficult conditions in Coast Province. Facilities in the Soil and Agricultural Chemistry Section have been expanded by the provision of a large new laboratory and greenhouse for pot investigations. The new buildings were opened on 15th December by the U.S. Consul General in Nairobi and the occasion presented an opportunity for the Minister for Agriculture to make a public acknowledgment of the great assistance which land use investigations in Kenya have received from America.

Development of the Plant Breeding Station at Njoro has continued and the main expansion of facilities has been completed. Special grants from C. D. & W. funds were received to provide for increased research on wheat rust and for launching the new programme of maize breeding at Kitale and Kakamega. The Senior Plant Breeder visited Central and South America and the Maize Breeder at Kitale has visited the U.S.A. and Central America on a study tour. These study visits were made under the aegis of the Rockefeller Foundation and the International Co-operation Administration. Short but useful visits were made by the Wheat Breeder and Pathologist from Njoro, to Turkey for the F.A.O. meeting of wheat and barley breeders, and to Ethiopia to make contact with scientific workers on breeding and rust epidemiological problems. The visit of Dr. E. C. Stakman from the Rockefeller Foundation to Kenya was of special significance. In his fortnight in the country he was able to give invaluable help and welcome encouragement to both breeders and pathologists.

The work of the Pasture Research Team attracts very favourable comment at all its stations.

Considerable progress has been made in resolving the programme of work required in the field of animal husbandry. Facilities for work on many stations have been greatly improved.

More effort is needed to get the results of research work across to growers in some sections of the Division. It can be confidently stated that a considerable volume of extension literature has been provided but it is necessary to pursue this matter relentlessly with all means possible so as to ensure that new knowledge is put into practice as soon as possible.

The publication of Dr. R. H. Le Pelley's book, entitled "The Agricultural Insects of East Africa", under a C.D. & W. grant is an event of outstanding importance and value to the science of entomology.

General Husbandry

Crops.—Maize trials at Kakamega and Mtwapa confirmed that 3 × 1 ft. is the best spacing at these localities. Taboran maize showed its value during drought at Mtwapa and the maize bred for resistance to *Puccinia polysora,* released last year on the Shimba Hills Settlement Scheme, appears to be well suited to local conditions.

Potatoes grew well at Dundori, at Kanja, and at Eldoret where the varieties P. 57, N. 57, L. 57 and particularly C. 52 were encouraging. At Kakamega one of the problems was storage of seed. At Mau Norok whole seed produced a significantly higher yield than cut seed.

Yields of castor were disappointing at Kitale, Msabaha and Kakamega. This crop appears to do best in drier areas where insect pests are not so prevalent. New tea trials are successfully established at Kakamega and at the Tea Experimental farm, Kagochi. 25 varieties of cassava were tested at Kakamega, Busia and Vuga, and growth was generally good. The highest yield at the Coast was 13.8 tons/acre, and six varieties showed complete resistance to mosaic. Soya beans are a promising alternative crop for Kitale.

In the cotton trials at the Coast, U.K. 51, the Ilonga Commercial strain and U.K. 58 yielded over 1,000 lb./acre. The latter, a new variety from Ukirigura showed considerable promise. At Galole five varieties under trial gave a mean yield of 1,300 lb./acre, I.58 and U.K. 51 being the best. No responses were obtained from fertilizers or green manures, and the greatest factor influencing cotton yields at Galole still appears to be early planting. Following the successful variety trial at Kampi-ya-Moto in 1958, it was found that cotton did not respond significantly to superphosphate, and yields were low.

Fertilizers and Manures.—The large programme of fertilizer trials directed from the Scott Agricultural Laboratories is reviewed under the heading "Soil and Agricultural Chemistry". Additional experiments were conducted by the field staff.

At Sotik, good responses to phosphate were obtained on maize, grass leys and potatoes and it seems that residual effects are more important than hitherto realized. Increase in yield of potatoes was particularly notable with 10.20.0 fertilizer. The efficacy of nitrogen application has been shown to depend partly upon time of application in relation to seasonable rainfall. Responses to phosphate and F.Y.M. were also recorded in many areas of North, Central and Elgon Nyanza.

Kikuyu grass responded significantly to F.Y.M., phosphate and nitrogen at Kanja and the enclosure of cattle on the grass at night resulted in a 300 per cent increase in grazing-days. On potatoes, a dressing of 1½ cwt/acre of double superphosphate gave greater increase in yield than 15 tons/acre F.Y.M.; effects of nitrogen application were inconsistent.

At Shimba Hills a small residual effect on maize is still evident from basic slag applied in 1957, but not from double superphosphate or F.Y.M. A marked response to calcium was obtained on a trial at Matuga but elsewhere at the Coast trace elements had no apparent effect.

In a comparison of manures at Eldoret, pig manure was again superior to manure from cattle and poultry and to an equivalent dressing of superphosphate. Green manuring of barley on a field scale was again found to be worthwhile at this station.

Animal Husbandry

Cattle.—The calf-feeding trials conducted in 1958 at Eldoret and Kitale were repeated and the results follow a similar pattern. Calves weaned off milk to a special meal at three weeks of age achieved only slightly slower liveweight gains than calves reared by conventional methods. However, the early-weaned calves grew more uniformly and this system was more economical of both labour and feeding-stuffs.

The feed lot system is being studied at Ol Joro Orok and preliminary observations indicate that there is no incidence of bloat with yard-fed cattle; also kale is consumed by yarded cattle with less wastage and without risk of milk taint. A trial was attempted to compare the first crosses of Hereford, Aberdeen Angus and Red Poll on Boran for beef production and to compare yard-finishing with finishing on grazing. Due to practical difficulties, results were inconclusive but there appeared to be no advantage in yard-feeding. It is hoped that further investigation of the particular design of the yard will help to explain the poor conversion ratios achieved.

A cow-feeding trial at Kitale was designed to determine whether the limiting factor in milk production is protein deficiency, carbohydrate deficiency or the inability of the Jersey to consume an adequate amount of dry matter. The results of the preliminary trial have not yet been fully examined but the experience gained has been of great value in planning future work.

Pigs.—Continuing from last year, work at Eldoret was concentrated on the correction of deficiencies in the protein complex found in a standard maize and meat meal ration. With direction from E.A.A.F.R.O. it was found that addition of nicotinic acid cured the prevalent dermatitis but alone was not sufficient to restore normal growth. Conversion ratios improved considerably after the inclusion of blood meal in the ration. It was concluded that local meat meal, notwithstanding its high protein content, may be deficient in certain essential amino-acids, and should not be used as the sole source of protein for pigs. Normal growth is always maintained where milk products are included in the ration. There was no benefit from the addition of an antibiotic.

In another trial a comparison was made of the maize portion of a standard ration fed on the cob and as meal. Maize fed as cobs resulted in slightly better grading of baconers and there was some saving in labour. Pigs fed on the conventional meal had slightly better conversion ratios.

Sheep.—Another attempt was made to produce Highland Mutton at the Eldoret station. Corriedales again made very poor gains on both Rhodes grass and rape. Investigations were commenced to correlate respiration rate and body temperature with air temperature, solar radiation, and relative humidity. Work on sheep is now being increased on a number of stations in different parts of the Colony.

Grassland

Kitale.—In the plant introduction and nursery work, 196 new introductions were examined. The following varieties of Red clover showed up well in nursery trials: Montgomery late, Louisiana, Kenland, New Zealand certified, Medium red and Chilean. Other species which did well are: *Dolichos lablab* (perennial variety), *Glycine javanica, Vicia villosa, Paspalum commersonii* from S. Rhodesia, and *Panicum maximum* from Nyasaland. These species will now undergo further tests in the field.

In preliminary grazing trials extending over 4 years, the best results with perennials were obtained from "Louisiana white clover" (*Trifolium repens*), *Desmodium uncinatum,* and "Hairy Peruvian" Lucerne. The best annuals were "Dwalganup" subterranean clover and the less aggressive varieties of *Trifolium rueppellianum.* This latter species, also Louisiana white and Subterranean clovers, had a beneficial effect on their associated grasses.

An interesting phenomenon has been the observation that certain wild bees transfer the pollen of some grass species, which does not seem to occur in temperate countries.

In the herbage agronomy work, further evidence was obtained on the merits of grass-legume mixtures compared with grass alone. The results conform with earlier experience, showing that legume mixtures may be expected to yield more than grass alone, given correct management and at least partial rectification of plant nutrient shortages. Kenya white clover, Louisiana white clover, and Lucerne continue to be the most important legumes for general purpose leys at Kitale and other medium altitude areas. In comparison of grass species under both clipping and grazing, Molasses grass, the Chepararia, Mbarara, Mpwapwa and Endebess strains of Rhodes grass, and the newly-introduced Coloured Guinea grass (*Panicum coloratum*) were the best yielders.

Work continues on different aspects of dry (late) season pastures. Evidence from three completed experiments shows, firstly, that the sowing of certain legumes such as *Glycine javanica* may be advantageous in special dry season mixtures with grasses such as *Panicum maximum*. Secondly, although 4-5 ft. between rows might be about the optimum spacing for the more vigorous Guinea grass varieties, the rows can be as wide as 8 ft. apart if required, without loss of yield. Thirdly, the "Gold Coast" and "French Cameroons" varieties of elephant grass are two of the best for dry season grazing under Kitale conditions.

In a comparison of the silage yield from the first cut of six forage species, maize and velvet sorghum significantly outyielded perennial Kavirondo sorghum, Sudan grass, Columbus grass, and oats. The yield of grain in a maize test crop following mixed grass-clover leys was significantly increased by residual gypsum which had been applied to the leys.

Intensive investigations on the effects of major and minor elements on the growth of grasses and legumes have been continued during 1959. Indications of a magnesium shortage in the soil have received further confirmation, both with Lucerne and Kenya white clover. Earlier responses to gypsum have been confirmed this year by a response to pure sulphur by lucerne. An interesting result was the response obtained to potassium application by lucerne, contrary to the results of former years. Significant responses were obtained to potassium on *Trifolium ruepellianum* and on Rhodes grass to which a basic application of triple superphosphate and magnesium and sulphur had been given. In an experiment with *Trifolium semipilosum*, a treatment with phosphate, gypsum, magnesium and borax, gave a better response than from phosphate and gypsum only.

The trend of the year's results is to provide further evidence of sulphur, boron and magnesium shortages and also evidence for potassium deficiency in addition to the well established deficiencies of nitrogen and phosphorus. Work now needs to be done to find what proportion of these elements to use in order to obtain maximum economic crop production.

In the animal agronomy work, for the evaluation of species, varieties or treatments by means of meat and milk production, first indications are now beginning to show after several years' work.

A grass clover ley was evaluated with and without the use of fertilizer over three years, by means of beef production. In 1959, the plots with fertilizer produced 473 lb. L.W.I. per acre compared with 284 lb. from the control. The economic value of the increase obtained is not very convincing at this stage, as it has taken two years to pay for the fertilizers applied. In view of the work done on soil deficiencies, it may well be that the nitrogen, phosphate and gypsum applied was not the best possible mixture.

In another experiment in which milk production was compared from leys of grass-clover and grass alone, using three pairs of identical twin heifers, the grass-clover ley produced significantly greater yields. Rhodes, Molasses, and Nandi Setaria grasses were compared by means of live-weight increase in twin cattle, but the small differences recorded were non-significant.

There are now 85 acres under seed production on the Station, and mother seed for the seed certification scheme is being produced for the following species: Endebess, Mbarara, Nzoia and Mpwapwa Rhodes grasses, Coloured Guinea grass, Slender Guinea grass, Nandi Setaria, Molasses grass, Kenya white clover and Rueppells clover. The seed production from Nandi Setaria was much reduced by the incidence of Bunt disease. and Clover seed production was poorer than usual. Production of grass and clover seed in the Trans-Nzoia shows a gradual improvement in quality and quantity.

In the Pasture Research Chemist's work, the effect of applying or denying fertilizer phosphorus or urea or both to star grass pasture over a period of four years have been investigated. Water-soluble phosphorus in relation to total phosphorus has been examined in star grass during active growth. The relationship between these two variables in the feed and faeces of Jersey cows in milk has also been investigated. A study has been made of the gross energy contained in plants at different stages of growth. Grasses, legumes and cereals have been examined to relate their total carbohydrate content to their crude protein, phosphorus and sulphur content. The total carbohydrate/crude protein ratio in relation to the "nutritive ratio" of the animal nutritionist has also been examined.

Molo Sub-Station.— The Molo Grassland Research Station was successful at the Royal Show in obtaining first prize for the best pen of Corriedale lambs fattened entirely on leys. Work on improving the quality and output of leys is the main line of work at the Station. A form of phosphate trial with Subterranean clover showed that rock phosphate, although better than the control, produced significantly lower yields than triple superphosphate, Kenaf, and basic slag which gave almost equal yields. In a rates of phosphate trial with subterranean clover, the greatest response per unit of phosphate was between 100 and 200 lb. of triple superphosphate, but significant increases were recorded up to 600 lb. per acre. Previous findings that phosphorus and calcium are the main deficiencies were confirmed, but a significant response to magnesium has also been obtained.

Selection work with *Trifolium burchellianum* var. *johnstonii* has produced some promising plants for use in leys, and there are some good varieties in the *Phalaris tuberosa* collection which seem to be an improvement on the commercially available types.

Katumani Sub-Station.—Dry weather showed up the lack of persistance of Rhodes grass even after only two years, and work was concentrated on *Cenchrus ciliaris,* which now appears to be the most generally useful ley grass for dry areas. Work on silage crops showed that in a dry season of only 7½ in. of rain, maize will still give as good a yield of dry matter as any other crop, though Bulrush Millet is equally good and has the advantage of a higher protein content.

Studies on burning to control bush have shown that certain species such as *Wedelia* are easily controlled whereas others such as *Acacia brevispica* regenerate very rapidly even after two successive annual burns. The value of a hot burn in opening up thick bush and allowing grass to come in has been demonstrated.

Kamasia Sub-Station.—During 1959 the work of the Kamasia Pasture Research Station at Marigat was centred in the rehabilitation and management of semi-arid grasslands of the Rift Valley Province, with particular reference to the African areas. Trials on the technique of reseeding denuded grasslands are following certain lines of approach suggested by the preliminary experiments completed during 1959. A year of poorly-distributed rainfall has had a deleterious effect on recently established experiments. Meanwhile, the selection of new grass material has been intensified, based upon the nursery at Marigat.

Work on bush control has been widened to include a more critical evaluation of a Holt IXa bush clearing machine. Machines of this type have a negligible killing effect on the bush species of the *Tarchonanthus-Acacia* complex, and current work is concerned primarily with the application of associated treatments aimed at arresting regeneration. Experimental work with the indigenous methods of control has been continued, and is beginning to yield results.

Studies and advisory work have continued on the controlled grazing schemes of the African areas. As a project separate from the work on natural grassland, investigations on lay grasses have been started in South Baringo, in order to cater for these areas of higher potential where individual holdings are being developed.

Further notes on the ecology of the area served by the Station have been collected during the course of other work; an ecological survey was undertaken of the Lower Uaso Nyiro, and the collection of plant material has proceeded incidental to work of this nature, the herbarium at Marigat now including about 800 specimens.

Sotik Experiment Station.—Work here has been mainly concerned with fertilizer experiments on crops and grassland. It seems that, apart from giving economic responses in the year of application, useful residual responses can be obtained by giving heavier dressings than those so far recommended and consequently smaller dressings in subsequent years may be adequate. When planting grass leys, the amount of phosphate applied at seeding should probably be increased above the old recommendation of 80 lb. of 40 per cent superphosphate per acre, owing to good responses obtained to seed-bed applications and inconsistent results from top dressing. On natural grassland, no economic improvement has so far been obtained from fertilizers, light cultivations or the introduction of legumes into the sward.

Coffee

Entomology.—The main lines of investigation in 1959 were aspects of the biology and control of the Tip Stem Borer *Eucosma nereidopa* Meyr., Leaf Miners *Leucoptera* spp., and the Antestia Bug *Antestiopsis lineaticollis* Stal.

Using flower buds and small green berries as food, a successful technique for the laboratory rearing of *Eucosma* was developed. Spraying shade tree trunks with two per cent D.D.T. caused large reductions in the moth population, but it is not yet clear if this alone is an adequate control measure. Many Leaf Miner samples were examined from both East and West Rift coffee areas. Eighteen species of parasitic Hymenoptera were recovered from larvae and pupae. There are probably few now awaiting discovery. The dominant species bred from caterpillars of *L. meyricki* Ghes. was an undescribed species of *Cirrospilus*. One surprising observation was that the shade-loving *L. caffeina* Washb. is absent or very rare in the West Rift, despite the fact that much of the coffee is shaded. Feeding experiments showed that, if *L. meyricki* moths are given mealybug honeydew, they are longer lived and produce more eggs than those fed on honey. Field observations have confirmed work at the Pyrethrum Board's laboratories that pyrethrum is ovicidal at spray concentrations as low as 0.001 per cent Pyrethrins. Leaf Miner eggs are also killed by Parathion, Methyl Parathion and Diazinon at the concentrations used for killing the caterpillars in the mines.

A two-phase method of Antestia control was devised for African areas and small plantations. Trees are sprayed with 0.006 per cent Pyrethrins and the stump is dusted with 5 per cent D.D.T. A Tachinid parasite, probably *Epineura rubens* Vill., was bred from adult Antestia collected at Kisii. It proved fairly simple to maintain in laboratory culture and it should be possible to liberate it in the main East Rift coffee areas in 1960.

During the year small scale investigations were undertaken on the control of coffee Thrips *Diarthrothrips coffeae* Will., Waxy Scale *Ceroplastes brevicauda* Hall, Brown Scale *Saissetia coffeae* (Walk.), the Yellow-Headed Borer *Dirphya nigricornis* (Ol.) and other minor pests.

Chemistry.—During the year, micro-pot test work was commenced, using the Chenery variation of the Webb technique. With tomato seedlings as indicators, comparative evaluations have been made of the influence of Napier grass mulch on the fertility of Kikuyu red loam coffee soil. Significant responses have been obtained from mulching. Effects of this practice have been rainfall conservation, improvement in topsoil structure, decrease of acidity and increased soil phosphorus, potassium and magnesium. Substantial yield increases have been obtained in field experiments and it has also been shown that regular Napier grass mulching maintains a higher leaf phosphorus level throughout the year, and particularly during the dry months when the crop is maturing.

A recent summary of fertilizer responses obtained in the experiments with different types and rates of nitrogenous fertilizer revealed that sodium nitrate is remarkably efficient in raising crop yield. A study of sodium distribution in the coffee tree was commenced to obtain basic information on the uptake by the coffee and dispersion within the tree. To date, soil analysis has revealed higher levels of exchangeable sodium in the topsoil from plots treated with this fertilizer; similarly, coffee feeder roots and young leaf have also been shown to contain higher levels of sodium. It now remains to determine what importance may be attached to this uptake.

In trials made over two seasons to assess the efficiency of fertilizer nitrogen applied as urea or ammonium sulphate, nitrogen applied as urea was less efficient than nitrogen applied as ammonium sulphate. However, 1957 and 1958 were both wet years and urea with its greater solubility would be at a disadvantage. Since, however, even in normal years heavy and consistent rainfall is received during the Long Rains it would be safer to avoid the risk of loss of nitrogen due to application as urea.

Soil samples have now been collected and analysed from the several manurial and cultural trials on the Station. A short investigation into the source of Amber beans in clean green coffee has revealed that they are produced in normally ripened cherry from iron-deficient bearing-wood.

Pathology and Physiology.—In the absence of a Plant Pathologist for the first seven months of the year work was concerned with routine observations on the fungicide trials for Leaf Rust (*Hemileia vastatrix*) and advisory matters. A small trial was laid down to investigate the possible toxic effect of monthly and bimonthly applications of the commonly-used copper fungicides and of captan and mineral oil. No adverse effects have yet been observed. The effect of concentrations of copper, as copper sulphate to 0.1 per cent applied at monthly intervals, was also tested. No scorch was observed and the effect of concentrations of up to one per cent is now being investigated. A further fungicide trial for Leaf Rust has been laid down with proprietary fungicides already accepted for testing but the main work on leaf Rust control has now been taken over by the Coffee Berry Disease Research Unit. The method of Leaf Rust scoring has been changed to fall into line with that used by the C.B.D. Unit. Leaf Rust has been quite severe and many infective periods have occurred throughout the year. Work has continued on the distribution of Race I which has been reported from several new areas and is now quite widespread throughout the Colony.

An investigation into a possible pathogenic cause of the "Crinkle Leaf" condition showed no reason to suspect a pathogen to be involved and the condition is considered to be closely related to "Hot and Cold" disease. A "Stem-pitting" survey was conducted with a view to obtaining pointers to lines of study which

might profitably be pursued (other than those connected with a virus causation) in respect of this condition. The survey confirmed the widespread occurrence of Stem-pitting throughout the Colony and emphasised the fact that the symptoms often start in the young plant, probably in the nursery. It is thought that further investigation is desirable.

The growth experiments in the Coffee Research Station and Scott Agricultural Laboratories were continued. At the Station, maximum growth occurred at the end of January, in April (Long Rains) and November-December (Short Rains). At the Laboratories, a growth peak at the end of February and early March was followed by a marked drop in the rate of growth, with a minimum in July; subsequently, growth resumed gradually towards another but lower maximum in November.

Preparatory work was required to investigtae stomatal movement and water deficit of leaves, the action of chemicals on leaf abcission, and carbohydrate and mineral nutrition.

Root washing in old coffee showed no differences between mulched and unmulched root systems. These unexpected findings might be ascribed to the trees being established a very long time before mulching was practised. Work on root development continues.

Coffee Berry Disease and Hemileia Research Unit.—In the search for suitable fungicides trials have emphasized that Copper formulations, when correctly timed, give more consistent control than Captan. Timing trials have confirmed that for all coffee-growing districts the period February-March is a critical one. While in Kiambu a yield response may be obtained to sprays applied in October and November the major response is to the February-March sprays. A 4 cwt. increase on an 11 cwt. crop was obtained. In Mweiga and the West Rift a second series of sprays is necessary in June and July.

In the laboratory a detailed investigation has been undertaken of the relation between meteorological factors and disease incidence. This will make possible prediction of the probability of attack in any given climate.

Experiments have been sited over a wide range of altitudes and climatic zones. Captan has given excellent control when applied over the period February-April. However, observations have shown that Copper applications in the period October and November remain effective over two or more epidemic cycles, whereas Captan is effective for one only. Results show that dispersal of the spores of this particular rust is not, in the main by wind. A beginning has been made to the laboratory study of the detailed effect of climatic factors.

Vegetative Propagation.— Extremely encouraging results were obtained with the N.I.A.E. Burgess type intermittent mist propagator during 1959. After a period of two months in the propagator the percentage of rooted cuttings was as high as 97 per cent, using capped single-nodal cuttings. Although several new root promoting substances were used, very satisfactory rooting was obtained when none was applied. Experiments have now been initiated to discover the best method of "hardening off" rooted cuttings from the mist propagator. Cuttings have been successfully transplanted directly from the propagator into the nursery beds and if the technique is perfected is should be possible to produce plants of sufficient size for planting into the field after a period of about 12 months.

From the compost trial the best results were obtained by using a compost consisting of $\frac{1}{4}$ (by volume) vermiculite, $\frac{1}{4}$ coffee hulls and $\frac{1}{2}$ coarse sand. Excellent results were also obtained using a compost consisting of equal volumes of coffee hulls and coarse sand. Inferior results were obtained when vermiculite was used alone and when mixed with an equal with an equal volume of coffee hulls or coarse sand.

Field Trials.—The yields from field trials at the Coffee Research Station picked in 1959 are notable for the consistency of the responses to mulch and nitrogen fertilizer treatments. Grass mulches between alternate rows of coffee trees raised yields by between 25 and 30 per cent. Rather lower increases were recorded (22 to 28 per cent) where mulch had been placed between all rows. Valuable responses to nitrogen fertilizers also were recorded in all trials in which they were tested.

An examination of data collected on coffee quality over the past ten years has indicated that no loss in yield of high quality coffee has accompanied the higher total yields obtained where nitrogen fertilizers and grass mulches have been used. Important increases in average bean size have been recorded where mulch has been applied and there have been indications that magnesium fertilizers improve the raw and roast appearance of the coffee bean.

Varieties.—As yield records are assembled from widely varying parts of Kenya the adaptability of S.L. 14, S.L. 28 and S.L. 34 becomes more and more evident. K. 7 remains the highest yielding of the selections resistant to leaf Rust (Race II) although S.L. 6 is generally more consistently immune to this Race. N. 100 has yielded well in several trials and there is some evidence that it has some resistance to Coffee Berry Disease. Blue Mountain and further selections from this type have given very disappointing yields although there is no doubt that they are somewhat resistant to Coffee Berry Disease.

Trials in African Areas.—In 1959 a new series of *Coffea arabica* variety trials was planted in the Meru, Baringo and Loitokitok districts. The Rust Exposure trials in Meru, Central Nyanza and South Nyanza districts were also extended. Exploratory trials with *Coffea excelsa* were also planted below 3,500 ft. in the Embu district.

During the year the first crop was picked from the Indian varieties S. 288, S. 333 and S. 795 planted in the Rust Exposure trials in 1956. All three varieties have continued to show immunity to Race I and Race II Leaf Rust (*Hemileia vastatrix*). If the liquoring quality and yields produced are satisfactory, they should prove invaluable in the Race I endemic areas of the Nyanza and Central Provinces.

The level of crop in Nyanza is now becoming clearly established. At the Kisii Farm (altitude 5,600 ft.) the highest yielding variety (S.L. 28) has averaged only 5.81 cwt. of clean coffee per acre during the years 1953-1958, compared with an average yield of 16.81 cwt. by the same variety at the Meru seed farm (altitude 5,500 ft.), Central Province. At Shikusa, North Nyanza District, the level of cropping has also been disappointing, the best variety, S.L. 34, yielding only 4.31 cwt. for the years 1957 and 1958. Yields were higher at Keumbu (altitude 6,200 ft.) in South Nyanza district, where the variety Kapretwa Series "A" produced a crop equivalent to 11.44 cwt. of clean coffee. It is now evident that yields in the region of 10 cwt. of clean coffee per acre can only be obtained in Nyanza Province at altitudes around 6,000 ft. where Leaf Rust is not a serious debilitating factor.

In the Chemoge variety trial (altitude 6,700 ft.) in Elgon Nyanza district, Elgon Dieback has severely attacked all the varieties in the trial, and the prospects for coffee development in this area must now be considered poor. The experimental plot of *Coffea excelsa* planted in 1957 at Ishiara (altitude 2,900 ft.), Embu district, produced a first small crop in 1959. Quality samples received favourable comments from the trade in Nairobi regarding both quality and market value. At Busia in Elgon Nyanza district, the large *Coffea canephora* (Robusta) trial is now well established and it is anticipated that the first crop will be picked during 1960.

Pyrethrum

Breeding.—141 new single plant selections were made and a total of 667 was under observation. New crosses (hybrids) were produced in 31 isolated plots and the "sugar beet" breeding systems were continued in twelve isolation fields at Molo (8) and Subukia (4). Seed production fields were either established or enlarged for C. 43, C. 45, C. 47, C. 92, M. 9, M. 11, M. 15, M. 31 and M. 34 and those for 100. A, Subukia Bulk, the two "Sugar Beet" systems, C. 60, C. 79 and M. 21 were maintained. A total of 5,234 lb. seed from improved varieties was delivered to the Pyrethrum Board for distribution to growers. Of the more recent hybrids, M. 41, M. 42, M. 43, M. 44, M. 47, M. 49 and 0.17 have shown promise and their parent clones are being bulked up. Altogether 22 yield trials in various parts of the pyrethrum growing areas were maintained.

Trials.—It has been found again that stripping down to and including buds caused a loss in pyrethrins while there was but little difference in the intervals between pickings. In the rotation trial, the yields in the continuous pyrethrum plots (controls) have so far not shown a significant decline in yield as compared with pyrethrum rotated with grass and/or cereals. This large experiment has now completed thirteen seasons. To interpolate one year of green manure (lupins) or cereals between two plantings of pyrethrum has no influence on succeeding yields.

Fertilizers.—There has been further evidence in favour of phosphorus applications at the higher altitudes on reddish soils. There is no difference, however, in effectiveness between superphosphate, basic slag or soda phosphate (Kenaf). In two cases an interesting interaction between lime and phosphorus was recorded. The fertilizer trials numbered fourteen.

Sisal

Nurseries.—Soil samples taken after 4 and 7 cycles each of about 1½ years show only small variations attributable to treatments. Good responses continue from sisal waste applications and from nitrogenous fertilizers. A significant response to nursery irrigation was obtained in the 3rd cycle only and irrigation technique will be studied further. Applications of F.Y.M. produced a less uniform stand in the nurseries than sisal waste, although the average plant size was similar. For the first time slight lime responses have been seen in two of the nursery trials lifted during the year.

Plant Management.—Spacing and cutting trials have all proved the possibility of growing 2,000 plants per acre irrespective of their locality in the Colony. Moreover, there has been indication that populations even higher than 2,000 plants per acre could be contemplated if reasonable access could still be obtained for tractors and labourers.

The double versus single-row trial demonstrates clearly the more rapid growth of the double-rows, resulting in earlier fibre yield. When high populations are aimed at the double-row system appears inevitable. Trials were planted to investigate desuckering, the effect of leguminous cover crops, and inter-row grazing of indigenous and introduced grasses.

Fertilizers.—The first fertilizer trial planted at the Station in 1950 was cut out during the year. No significant responses were obtained from lime, phosphate or potassium. Application of sisal waste caused no significant difference in leaf numbers per plant although fibre yield was increased, due to more rapid growth and a longer leaf. Nitrogen application increased both leaf number per plant and fibre yield. It is clear from results obtained that sisal waste application of less than 50 tons should not be contemplated and also that nitrogen applications must be repeated possibly twice a year for the first 3-4 years.

Observation areas were planted during the year at Kibwezi and Nakuru to demonstrate in large blocks the preliminary findings of the fertilizer trials.

Other Work.—Work continues with herbicides, including phytotoxic effects, and dalapon spraying has been effectively demonstrated.

Horticulture

Organization.—The Horticultural Products Committee was appointed and has been active in co-ordinating the several interests of the industry and in advising the Minister. A Research Advisory Committee was appointed for the Thika Station.

Marketing.—Exports of horticultural produce by air to the U.K. increased both in variety and quantity. Kenya luxury produce, notably pineapples, avocadoes, asparagus, mangoes, passion fruit, and strawberries and French beans for the Christmas trade, has established a good reputation in Covent Garden. The financial value of the London trade is not large, limited as it is by the high cost of air freight, but the prestige value to Kenya is very considerable. Air exports to Aden have also been considerable, although the quality of produce required is not of the extremely high standard demanded by London.

During the last three years the value of fruit imported into Kenya has almost doubled. A great part of this could have been produced locally, with consequent benefit to the economy of the country. Serious consideration is therefore being given to the stimulation of local production of some of the imported items; that this is possible has already been demonstrated in the case of onions.

Citrus.—Investigations were continued in connexion with the proposed citrus juice industry. Commercial assessment of samples of lime and lemon was favourable. Citrus trees planted at Jacaranda in 1951 are showing symptoms of decline, which appears to be due to the inability of the root system to penetrate beyond the topsoil. Consequently, Kikuyu Red Loam soils cannot be recommended for commercial planting. At Mtwapa there has been virtual failure of recently-planted citrus trials, due to drought. Nursery production is going ahead at Matuga, but careful consideration will have to be given to improving establishment methods for tree crops at the Coast.

Tomatoes.—Production of canning tomatoes decreased considerably when the puree plant near Nakuru closed down. In a trial at Thika on blight control (*P. infestans*), sprays containing copper, zineb and captan all greatly increased yields. At Mwea-Tebere, tomatoes yielded well but there was no response to sulphate of ammonia and no residual effects from F.Y.M.

Asparagus.—At Thika the second harvest of asparagus produced a high percentage of unsaleable spears. Until the cause of the trouble is known, growers in this climatic zone are advised not to plant large areas of asparagus. At Molo the results from the spacing and harvesting trial indicate that the economic life of a planting is unlikely to be much more than four years in that district. The crop grew well at Mwea-Tebere.

Strawberries.—The fall in local prices predicted in the 1958 report took place towards the end of the year. This might have been avoided if more of the fruit produced had been of export quality. Strawberry trials at Molo indicate that the economic life of newly imported plants is only three years. A fertilizer trial showed that 40 tons of F.Y.M. per acre produced a significantly higher yield than wheat straw fortified with N.P.K.

Pineapples.—Owing to decreased acreage the canneries were unable to obtain enough fruit for most economical operation and a campaign for increased planting is now in progress. The commercial pineapples planted at Thika in June, 1956 completed their plant crop and gave an average yield of 11.5 tons per acre.

the poor yield was due to the low fertility of the soil and insufficient applications of nitrogenous fertilizer in the early stages of growth. There are probably few, if any, virgin soils of high fertility remaining in the Thika area, and new plantings will be made on replant areas or land of low fertility. Pineapples do not respond to late remedial dressings of fertilizer.

Plant Pathology

Plant Diseases.—During 1959 a record of 638 pathological specimens were examined and six new disease records were confirmed.

A start has been made on the standardization of the fungicidal components of seed-dressings, in the control of seed-borne diseases of food crops. With barley, organo-mercurial seed dressings at levels of 20 to 40 ppm Hg on the seed gave control of seed-borne infections of *Pyrenophora teres, Cochliobolus sativus* and *Rhyncosporium secalis* though, airborne spores of the latter gave rise to Scald of the upper foliage at a late stage of the crop, at some locations. Head Smut (*Ustilago reiliana*) *and White Blight* (*Helminthosporium turcicum*) continue to be serious diseases of maize. A series of combined insecticidal-fungicidal spraying schedules is being compared in the control of Powdery Mildew and insect pests of mango in Coast Province. Research on other aspects of cereal pathology continued at the Plant Breeding Station, Njoro. The main project concerns studies on the epidemiology of Black Stem Rust. Breeding material was screened for rust resistance.

Legume Bacteriology.—A *Rhizobium* "bank" has been constructed for the maintenance of selected strains of *Rhizobium* in root nodules on leguminous host plants.

Seed Testing.—2,699 seed tests were undertaken. Certificates for Government Certified and Government Tested seed were issued for the first time. Germination tests were carried out on hop seed from America and passion fruit seed from Australia.

Potatoes.—Samples of 34 potato varieties kindly donated from seven sources were imported during the year for evaluation of performance and resistance to blight in Kenya conditions. A colony-wide survey of bacterial wilt of potatoes begun in March, was still in progress at the end of the year. Meanwhile 81 potato specimens with bacterial wilt, from all areas but specially from the Embu district, have been received for diagnosis during the year.

Eelworms.—Plant parasitic nematodes have been recorded on many crops. Particularly important is the root knot nematode, which has a wide host range. Work on control of eelworms, including the effect of rotations, is to be increased in view of the serious damage these organisms cause to a wide range of crops.

Entomology

Taxonomic work on the Coccidae included a survey of the East African forms of Green Scale of coffee. Work on Ceroplastes continues. Large numbers of mealybugs from East Africa and South Africa were studied and between 70 and 80 new species recognized.

The Cochineal insect *Dactylopius tomentosus* continued to multiply and showed great promise more particularly on the type of prickly pear with thin bracts which occurs at Mariakani and Mohoru. Against types with thick bracts it is less effective but good progress is reported from Naivasha.

The Lantana seed fly, *Ophiomya lantanae* has now spread throughout the Colony. The Lacebug *Teleonemia scrupulosa* liberated in Nyanza appears to have died out but is now causing appreciable damage to Lantana at the Coast. A leaf skeletonizer. *Syngamia haemorrhoidalis* was introduced from Hawaii to attack

Lantana but it is not yet known to be established. At the Coast, bio-assay work on the Coreid bug of coconut was completed and small hand spraying machines obtained for a large-scale proving trial.

Cotton pests caused less damage than usual but the bollworm *Heliothis armigera* caused considerable damage especially towards the end of the season. Full control of pests on the Msabaha Cotton Research Station resulted in a crop value increase of 75 per cent as compared with 114 per cent in 1958 and 294 per cent in 1957. Excellent results were achieved against cotton pests by aerial spraying on the Tana River Irrigation Scheme but a sudden late attack of *Heliothis* bollworm occurred after the completion of the main spraying operations. Cotton pests in Nyanza suffered from a severe drought in June and July and numbers of stainers and bollworms were low in the Lake Shore area. 3 per cent gamma BHC/10 per cent D.D.T. dust increased yield by some 30 per cent and was superior to Endirin/Malathion/D.D.T. dust mixture at Kibos.

Eretmocerus serius, a parasite of the black fly of citrus, *Aleurocanthus woglumi*, a serious pest of coastal citrus was introduced in November from the Seychelles, and the parasite appears to have established itself.

Dieldrin spraying against banana weevil gave smaller yield increases than did mulching. In the Rift Valley Province seed dressings of dieldrin, heptachlor, or aldrin against Barley Fly gave superior control to all others. Dieldrin seed dressing at $3\frac{1}{2}$ oz. of actual dieldrin per 100 lb. of seed was as effective as the recommended dose of 5 oz. Severe attacks of the chafer grub *Schizonycha* spp. occurred in maize and wheat in the Trans Nzoia and spraying with dieldrin and chlordane did not give satisfactory control. Seed dressings of dieldrin, aldrin and heptachlor showed promise in shallow trays. Good control of pyrethrum thrips outbreaks has been achieved by spraying D.D.T. twice at an interval of 10 days. Metasystox gave good control of both thrips and red spider mite. Work on *Nematocerus* weevils is being assured a high priority because of serious damage to wheat. A second large maize stack experiment, using polyethylene covers to give long-term protection, was completed and gave results which justify further large-scale trials. A stack experiment involving layer dusting of maize with 1 per cent Lindane gave conclusive proof that the technique was not economic. Results from a crib experiment showed that when sprayed hessian sheet was used within the wire the addition of resin had no significant effect.

At the Coast ship inspections were carried out in the search for *Trogoderma* and two inspections were made up-country of wheat in stores and on farms. An increasing tendency for wheat to be weevil infested was noted. Considerable progress has been made on treatment of stored products under Coastal conditions, especially the evaluation of malathion and aluminium phosphide treatments.

Soil and Agricultural Chemistry

Nineteen fifty-nine saw a continuation of soil survey activities. The survey of 130,000 acres in the north-eastern Kano Plains and surrounds was written up and the Directorate of Overseas Surveys has undertaken without cost to Kenya to print the maps accompanying the report, together with similar maps which will accompany some of our subsequent soil reports. Meanwhile, field work on the survey in South Nyanza has been completed, the acreage actually surveyed amounting ultimately to 99,206. The survey has been written up and soils and sugar suitability maps have been drawn, mapping again being on the scale of 1/50,000. Between one and five phases each of 37 different soil types and miscellaneous land types were described and mapped. Field descriptions and analyses were given of 24 typical profiles from the main series found. Some 21,000 acres of land which is considered suitable for sugar cane production and some 45,000 acres considered usable were found during the survey. The genesis and classification of the soils concerned also were investigated.

In connexion with an investigation of the hydrology of the northern Uaso Nyiro and with the formulation of proposals for the utilization of its waters, reconnaissance surveys were made of the soils in those parts of the water-shed where physical studies had suggested that possibilities exist for the extension or development of irrigation. Quite extensive tracts of suitable land were found and demarcated for the hydrologists. Another reconnaissance survey at Michimikuru, Meru District so fully confirmed the suitability of the soils that its completion was followed immediately by major investment in tea growing in the area. Some 20,000 acres of land in the Sotik District were surveyed with the object of providing local agricultural staff with the basis for the classification and further mapping of soils in their district. A soil survey at Nakuru is well under way. Additionally, Dr. Thorp continued his travels in Kenya collecting material for preparing the proposed classification framework for local soils.

Having built up the organization necessary to handle adequately soil examination procedure, Dr. Mehlich has written up the methods in detail and worked out a provisional scheme for their interpretation. The accumulation of data resulting from the introduction of these procedures is providing the basis for delineating with increasing accuracy the variations in nutrient status which occur over Kenya.

The Webb-Hewitt and *Aspergillus niger* investigations of selected soils paralleling the routine soil analyses continued, 49 soils being examined by these techniques during the year. Apart from the usual widespread nitrogen and phosphorous deficiencies a prevalence of sulphur deficiency on Grumosols is becoming apparent. Instances of low boron status also have been observed though supplementary confirmatory tests on crops other than tomatoes have been inconclusive. Further investigation of the extent of copper deficiency near Nakuru was undertaken by both pot tests and *Aspergillus* measurements.

The completion of the land use investigation cycle by the testing of laboratory and greenhouse findings in the field was marked by the initiation of further fertilizer trials, mainly on sugar in the eastern Kano survey area, in which attempts are being made at adjusting deficiencies. The usual fertilizer trials programme in all farming areas was also maintained, increasing emphasis now being placed on rates trials where the exploratory trials programme had established the existence of major nutrient deficiencies. It was possible to correlate laboratory findings and field results which had been established previously with increased precision. The introduction of Taboran maize in the Southern Province trials led to a notable improvement in the standard of experimentation in the dry areas. Accordingly, good progress in resolving fertilizer responses was possible. The phosphate responsiveness of the weaker coloured soils followed the chemical phosphate indications and all these soils responded to sulphate of ammonia. The stronger coloured soils almost without exception responded to superphosphates but gave variable responses to nitrogen. The pallid and the stronger coloured soils all responded well to manure.

The lime investigations continued at three of the four original sites, all sites being under or put down to grass during the year. At Marindas the grass in its third year deteriorated and the earlier responses disappeared but at Eldoret the response in the second year to liming was quite distinct whilst the nitrogen application and phosphate residuals have favoured the grass relative to the clovers. On both these trials the pH values resulting from liming have been sustained. At South Kinangop some fall in pH with lime has become apparent so half the trial was re-limed before going into grass. Here, the preceding crop of kale has shown a notable response to the original lime application, to superphosphate and to the NK mixture, the response to lime being among the best yet recorded in these trials. On the other hand, the first three months' grass growth has shown no response to the original lime application but has shown a considerable response to the re-application. The associated laboratory investiga-

tions have shown that liming appears to cause some increase in nitrification power but the difference between sites is much greater than between lime treatments. The nitrification pattern, the effect of liming on citric soluble silica and the relationships between citric soluble silica and phosphate response on the limed soils were in accord with already published observations on unlimed soils in East Africa. No influence was observed of liming on the solubility of soil iron.

The wheat quality investigations continued to concentrate on the development of zone electrophoresis for the fractionation of gluten proteins. While a fully satisfactory medium still remains to be found, sponge rubber has proved distinctly promising for this purpose and with it differences between the composition pattern of gluten of varying strengths have been demonstrated. Agronomy investigations continued to be inconclusive, none of the soil management factors yet investigated having a consistent influence either way on dough strength.

Encouraging reports have been received on citrus juice and Reunion Geranium oil samples submitted to the U.K. and some trade interest has been stimulated in Mexican Marigold oil.

Plant Breeding

Wheat.—Concerning wheat problems, 1959 was a rather paradoxical season. In the country generally a record year has undoubtedly been experienced, largely due to drier conditions and to less stem rust than for many seasons. Most varieties did well, even those which are currently considered as unsafe. On the other hand, such stem rust as did occur was mainly of Kenya race K18, which corresponds to International Race 40. This race and K19 (Int. Race 189) seem able to attack most varieties in commercial use and constitute a very serious threat to the industry. They caused very heavy damage at Njoro. The International and F.A.O. Nurseries were as badly attacked as ever, and the number of varieties extracted correspondingly fewer. The range of crosses dating from 1955 yielded many selections that look very promising, and these now go forward for initial multiplication.

The large new backcross programme begun in 1958 has been pushed forward at the rate of two seasons each year, but has run into unexpected complications. Rust levels (race K.18) in all 940 of the backcrosses were uniformly high in the second season of 1959 and selection of resistant plants was virtually impossible. This setback needs full investigation and is especially unfortunate at this time.

Multiplications of newer varieties have been more successful. A range of high altitude varieties was released for 1959 under the names Kenya Curlew, Eagle, Hawk, Buzzard, Dove, Plover and Quail; they have yielded well and two of them have baking quality that is better than usual for a high altitude variety. Plover especially is good. All four of the varieties at pedigree stage had a successful season and should be ready for release in 1960; these are Afric Mayo, Kentana Yaqui (2587). Wisconsin 245 x Supremo and Mida-McMurachy-Exchange.

Maize.—Maize breeding has made very satisfactory progress at both Kitale and Machakos. The Kitale Synthetic II was multiplied on five acres and gave the highest general level of yield in the six ecological trials. Mention has already been made of the fresh expansion of maize work now started at Kitale and Kakamega, and it was particularly opportune that the plant breeder in charge of this was able to visit the U.S.A. and Central America this year. His programme aims at producing hybrids as well as synthetics, with special emphasis on im-

proved resistance to white blight and rust. Synthetic II shows signs of some achievement in this direction already. At Machakos the work was directed at earliness as the best means of combating the drought conditions which so frequently prevail in Southern Province. The quick variety Taboran is now being grown by many African farmers; 10 tons of seed were sold in the various districts. The Early Synthetic has yielded well in multiplication and this too should be a welcome new variety in the Province for the hill areas. Here again, future work aims at adding better blight resistance to the new issues.

Another season of success can be reported with the new maize stock resistant to tropical rust. After bulking at Shimba Hills this year there are now over 1,000 bags for further distribution in the Coast Province for 1960. This rust has become an established disease at the Coast, but not up-country. The danger thus seems more local than at one time was feared and it is hoped that the issue of this resistant stock will now limit its effect still further.

Irrigation

Galole.—Crop investigations on the Tana Irrigation Scheme continued with the land reclamation and fertilizer trials programme, with cotton and soya bean trials, and observations on new crops. The 1959 programme extended to the investigation of fish farming on the heavier soils which occur in the drainage ways in the desert hinterland.

The importance of pest control, particularly in cotton and maize, was accentuated this year by constant threats of attacks by maize stalk borer, American bollworm, pink bollworm, cotton stainer, red spider mite and numerous species of caterpillar. Five sprayings were necessary to control American bollworm.

In the cotton variety trials the objectionably long growing season of the Egyptian varieties once again was apparent. On the other hand, the short term Ilonga cottons were outstandingly successful, yields of over 2,000 lb. seed cotton/acre being obtained in five and a half months on large plots. This compares with a scheme average of 813 lb. A grade/acre in six to six and a half months with U.K.51. The programme for maintaining the quality of the cotton seed was successfully initiated with the establishment of a 20-acre isolation plot of Elite U.K.51.

Cowpeas and green grams grew successfully, but yields of soya beans and groundnuts were disappointing. Efforts to grow maize on a large scale were continued but the crop has a yield potential of only eight to nine bag/acre. Of other crop introductions, date palms are promising.

Water distribution and moisture penetration have been the subject of special investigations and improvements were achieved towards the end of the season. Foliar abnormalities of some of the Scheme's crops suggest deficiencies of iron, magnesium and manganese apart from water-logging and local salinity. Manganese deficiency has been confirmed in laboratory tests and the chemical aspects of these desert soils are being further investigated.

Mwea.—Work on rice included experiments on the fertilizer, spacing and water requirements and the variety collection was increased by varieties from U.S.A., Nigeria, Japan, India, Austria and Surinam. On the variety Sindano application of 1 cwt./acre of both double superphosphate and sulphate of ammonia gave large responses but heavier dressings did not give an appreciable further increase. A spacing of 6 in. by 6 in. outyielded wider spacings. Field scale trials of direct sowing and mechanical harvesting were carried out.

Fish ponds, for the rearing of *Tilapia nigra*, were maintained in conjunction with the Chief Fisheries Research Officer.

On the red soil area work was continued on irrigation methods and the most promising crops were asparagus, melons, onions, sugar cane and hibiscus fibre. In fertilizer trials on unirrigated red soil large responses were obtained on maize to F.Y.M. at 10 tons/acre and sulphate of ammonia at 1 cwt./acre.

Perkerra.—A clear policy has now been laid down for the tenants on this scheme. They will grow food and cash crops including tree crops. The grass phase of the rotation, together with a small permanent area of fodder crops, will allow for the keeping of livestock and, in addition, a small free cultivation area has been included wherein the tenants will be able to grow crops of their own choice. In the earlier years of this scheme the investigational work was not very well provided for and the programme tended to cover a very wide field. Nevertheless, a considerable amount of valuable information was accumulated. Now that a definite policy has been determined it is possible to intensify work on activities which have been given a place in the new scheme policy. Work is being concentrated on improving the yields of maize and beans, including soya beans; onion production, which crop shows great promise as a main cash crop on this scheme; the maintenance and management of Star grass and other pasture species; fodder crops; tree crops including citrus, bananas and dates; and an examination of production possibilities with zebu and cross beef cattle and exotic dairy stock. An area of approximately 100 acres is available for experimental work on the main soil type at Perkerra and a subsidiary plot will be provided to cover the development of the second important soil type. Water use studies continue in co-operation with E.A.A.F.R.O.

Agricultural Machinery Research and Development

(*Agricultural Officer* (*Engineering*), *Nakuru*)

Trials.—The Prototype Newage Hibiscus Ribboner was tried out at Mwea, and Dr. Kirby of the Tropical Products Institute was of the opinion that the upstriker model was as good as any ribboner he had seen. The Hibiscus decorticator manufactured by The Bell Engineering Co. Ltd., of Umtali, Southern Rhodesia, was tried at the end of the year, but no suitable material was available for a complete trial. The Holder tractor was demonstrated at Machakos, but the agents were not prepared to submit it for trial until they have had more experience with it on coffee farms.

Demonstrations.—A demonstration of plough setting and use was given at Kitale, which about 50 farmers attended.

Experimental Equipment.—A plot seeder was constructed to give accurate sowing and easy cleaning for seed dressing trials. The mechanism appeared satisfactory but mounted on a two-wheeled tractor it tended to be unmanageable.

Terracing Machinery.—Comparative trials of three different machines for the construction of terraces and cut-off ditches showed that for the construction of V terraces there was little to choose between a motor grader, crawler tractor and trailed terracer, or of a four-wheeled drive tractor and small trailed terracer. For broad based terraces and cut-off ditches the small tractor cost about 50 per cent more than either of the larger machines.

Sisal.—A study made of the operations involved in the cutting and transport of sisal leaf showed that a cutter spends between 57—67 per cent of his time cutting, 18—31 per cent bundling the leaves, and 12—15 per cent carrying the bundles to the end of the row. It would appear that a saving of 20—30 per cent in the cutting labour requirements could easily be achieved with new methods. Work is in progress on the following: field decorticator for estate use; hand decorticator for African areas; equipment for de-suckering and control of grass down the rows; driers (including methane production and utilization of solar energy); alternative systems of leaf transport.

Coffee.—Trials with a cascade type of drier have shown that a layer of coffee one bean thick can be made to flow down a perforated tray with a slope of 10° when air is blown through the tray with a velocity of 800—1,200 F.P.M. according to the type of perforations. An experimental drier constructed on this principle having wire trays measuring 3 ft. by 1 ft. had a throughput of 650 lb. of coffee per hour drying from fully wet to skin dry.

General.—Investigations are being made into the type of machinery most suited to African agriculture and the possibility of alternative methods of cultivation.

Agricultural Machinery Testing

(E.A.T. & I.T.U., Nakuru)

The East African Tractor and Implement Testing Unit based at Nakuru continued to operate in 1959 though work was reduced by leave movements of the testing staff.

A.—Tractor Section

1. *Farm Trials.*—The first and major part of the trials on the five tractors was satisfactorily concluded and the report prepared for approval by the N.I.A.E. and the manufacturer, who has requested the trial to run for a further year to provide extra wear information. The tractors are farmer owned and situated one each in Tanganyika and Uganda and three in Kenya.

2. *Altitude Investigation.*—One further test was concluded and the report has been published by the manufacturer, who has instructed the agents regarding engine settings for various altitudes.

3. *Standard Altitude Tests.*—Two tests were carried out and the reports prepared. The manufacturers concerned have not yet approved publication of the reports.

4. *Uganda Government.*—Trials with the four different tractors at Serere Research Station will not be completed until 1960. The Special Developments Section co-operated with the Unit in Farm Trials tests and fuel filtration problems, which resulted in official requests for tests on fuel/water separation systems by two U.K. manufacturers.

5. *Special Tractor.*—The specially modified tractor has now completed 18 months very satisfactory work and the Special Developments Section of the Department of Agriculture, Uganda, have modified several other tractors in a similar manner.

6. *Cooling Problems.*—The assistance given to one manufacturer in 1958 in solving an overheating problem has led to an investigation into cooling characteristics of tractor engines in East Africa and one tractor is currently under test.

7. *Survey.*—The survey in 1958 covering tractors in East Africa has been studied in the U.K. and has led to a request for a comprehensive survey to be carried out in co-operation with the Field Investigation Department of the N.I.A.E.

8. *Tractor for African Smallholdings.*—This subject is beginning to assume considerable importance and discussions were held whilst staff were in the U.K. with the N.I.A.E. and four manufacturers. Work is in hand in respect of several aspects of this formidable problem and the Unit is in close touch with T.A.M.T.U. (Tanganyika), S.D. Section (Uganda), and numerous manufacturers and agents. Work with a conventional tractor in the African areas is currently in progress and five two-wheeled tractors or motor cultivators will eventually be tried after their tests with the Implement Section. Several small four-wheeled tractors may be entered for trials by the manufacturers.

B.—Implement Section

1. *Series Tests.*—Work continued on the testing of various machines in light bush clearing, pasture topping and grass land improvement. The work now includes the use of chemicals.

2. *Ordinary Tests.*—Tests were completed on the following machines and reports have been published by the manufacturer concerned:—

(*a*) Wilder Multi-Masta.

(*b*) Wolseley Super Swipe.

(*c*) Simms Inertia Starter.

Tests were completed on the following machines but the reports have remained confidential to the entrants:—

(*a*) Ransome Prototype Groundnut Harvester.

(*b*) N.I.A.E. Experimental Cultivation Equipment.

(*c*) N.I.A.E. Tie Ridging Equipment.

This N.I.A.E. equipment has now been transferred to Tanganyika, where the Government are carrying out further trials in conjunction with E.A.A.F.R.O. and the Unit to assess the agronomic aspects.

Tests in progress at the end of the year were as follows:—

(*a*) Messrs. Gailey & Roberts Pyrethrum Drier.

(*b*) Holt Mk. VIIIb Bush Breaker with spray attachments.

(*c*) Ransome Prototype Rotary Slasher.

3. *Other Work.*—The Section has helped and advised various Government Departments on numerous mechanization problems, e.g. Hibiscus Ribboner, chain felling, combine conversions, forage harvesting and bean threshing.

The requests for tests at the end of the year were so great that the Unit has been forced either to refuse or suggest the delaying of the applications.

PART III—FIELD SERVICES

Progress in Improved Farming

European Areas

The rapid pace of development in the mixed farming areas of the Highlands continued in 1959. The price of good farming land remained high and continued in demand. Heavy calls were made upon the Advisory Services and there remains a backlog of applications for farm plans in spite of the fact that 42 farms were dealt with in detail during the year.

There was a steady demand for Development Loans administered by the Board of Agriculture and a total of £216,705 was issued to 128 farmers for livestock acquisition, fencing, water installations, dips and sprays, buildings, machinery and miscellaneous items. By the end of 1959 the total amount issued stood at £858,797 to 548 farmers.

Asian Areas

The sugar-cane area in Central Nyanza suffered severely from drought and deliveries of cane were well below average. The advice provided by the Department has effected a marked advance in cultivation standards in the area. The Miwani Sugar Mill was modernized during the year.

In the Coast Province progress on Asian owned plantations has been general. The Ramisi Sugar Estate increased the planted acreage to 10,424 acres. Factory capacity is to be increased to cope with this expansion.

African Areas

Nyanza Province.—There has been a heartening response to the advisory services throughout the Province associated with a growing interest in better farming and a realization that sound crop husbandry can be made to pay. There is reported in this Province a growing atmosphere of trust and confidence in the work of the Department, and such basic practices as row planting, the use of manure and clean weeding are becoming widespread. In Central Nyanza land consolidation made good progress and by the end of the year 65 sublocations were involved. 1913 families had consolidated and enclosed their land and 10,254 acres had been marked out with simple farm plans or layouts. In North Nyanza 12 out of 17 locations were undergoing land consolidation with 952 farms consolidated and 385 actually enclosed covering 8,368 acres. In Elgon Nyanza progress is reported in 13 of the 40 sublocations and 5,550 farms covering 56,772 acres have been marked out for enclosure. In South Nyanza 1,884 acres of farms were consolidated while in Kericho District enclosure which has been in progress for some years has resulted in a position in which 20,000 farms covering 230,000 acres are enclosed.

Loans were made to farmers in Nyanza Province by the District Loan Boards as well as to Co-operative Societies and Location Councils, the latter being mainly for water supplies.

Progress in farm mechanization in the Province goes slowly. Carelessness on the part of African tractor operators frequently leads to serious troubles which at present bring a tractor to a grinding halt often to lie derelict for want of the ready cash to pay for repairs.

While the results of experimental work enable fertilizer recommendations to be made for all parts of the Province there has been no appreciable development in their use. Interest at present is concentrated on the use of F.Y.M.

Rift Valley Province.—The planning of the African areas of high potential continued apace during the year. In Elgeyo District 4,000 acres were planned on a skeletal soil conservation layout and water supplies laid on. In the Kaptarakwa,

Ngaru and Moiben locations of this district contour fencing and paddocking is accompanied by dairy buildings, milk recording and standards of cleanliness which are impressive and which can be traced to the progressive influence of neighbouring European farms as well as the work of the Departmental extension services. Progress was also made in the Nandi District which on some individual farms was quite outstanding. In the drier areas of the Province grazing control schemes were extended to arrest the onward march of the desert. In some of the schemes however the grass cover still consists of annual species and dry seasons ahead may prove critical. Water development continued to receive attention with further water holes being constructed in Baringo as well as piped water supplies to cover 9,000 acres. The piping of water supplies and protection of springs went ahead in Elgeyo and Nandi as well as preliminary work on water-hole construction in West Suk. Interest continued in cash crops the demand for tea and coffee being strong and likewise for pyrethrum planting material. Stock sales continued to provide the main income for these areas and sales of cattle totalled 53,377 head in 1959. Sales of sheep and goats also increased particularly in Baringo District.

Central Province.—With the completion of land consolidation in many areas work became concentrated on the planning of the resulting unit holdings. Over 7,000 farm layouts were completed in 1959 throughout the Province and at the end of the year 13,644 African farms in the Province had been laid out of which about one-half were making good progress. The results of the Emergency are still being felt in some areas and cattle sheds have fallen into disrepair with inadequate supplies of manure available on some holdings due to the slowness of the return of farmers to live on their holdings.

Progress in farm mechanization has been slow but tractor ploughing in Embu District in the initial stages of development has accelerated progress. Mechanical spray equipment is becoming a necessity for Coffee Co-operatives for the disease and pest control and toxic spray programmes.

The use of nitrogenous fertilizers on coffee has increased and there are indications of rapid developments in this field.

Many loans to progressive farmers have been made and Bank loans have been made available where the applicant has received the approval of District Agricultural Staff.

Southern Province.—With the increasing numbers of people in this Province who make their living from the land most effort has been put into the proper preparation, cultivation and manuring of crops to ensure as far as possible that subsistence is maintained. A record amount of benching and terracing was completed during the year. Over 6,000 acres was bench terraced alone. Good progress has been made with improved crop husbandry including the use of fertilizers. A few new tractors have been acquired in Machakos District where they are used for ploughing and gristing on market days. The improvement of the local livestock with Sahiwal blood has started on a small scale but the provision of adequate grass and fodder is a major problem in this Province. Progress in land consolidation continued especially in the Kangundo and Matungulu locations. A survey of 240 acres of this area revealed that of 52 landowners involved 27 were fully consolidated. The survey indicated that 55 per cent of the people concerned had consolidated involving 75 per cent of the land.

Coast Province.—Land consolidation made good progress in the Taita Hills. Over 1,000 acres of land consisting of 192 farms had been planned by the end of the year. Progress continued on the Coconut Improvement Scheme and 40,000 seedlings were issued in Kwale District and 17,200 seedlings in Kilifi. At Kipini 2,650 seedlings were issued from a small nursery. The planting of cotton in a pure stand has again increased in the Malindi Subdistrict. Fertilizers are not used

on any scale by Africans in the Province but the use of manure continues to increase particularly in the Taita District. Mechanical cultivation is confined to the estates in this Province but ox-drawn ploughs are being increasingly used. In Kwale District three farms at Shimba Hills Settlement were supplied with a piped water supply from an African District Council dam. They will pay a water rate.

Reconditioning, Resettlement and Development Schemes

Nyanza Province

Lambwe Valley.—The total number of settlers has now reached 444. A slow trickle of new settlers continues into the scheme mostly from Central Nyanza.

Kimulot Scheme.—The income derived from the first sales of tea leaf has supplied the necessary boost to this scheme. One of the best growers is likely to realize Sh. 250 for his tea leaf for the last quarter of the year. Results such as this are encouraging farmers to give up outside employment and devote their whole time to their holdings.

Itembe Scheme.—The perimeter enclosure of holdings was completed during the year and more than half have had a simple farm plan or layout. The development of grazing and eradication of *Pennisetum catabasis* proceeded and a water scheme was installed. Monthly incomes from the sale of cream now average Sh. 35 to Sh. 40.

Kibos-Awach.—This scheme which hitherto covered only the catchment area of the Awach River is to be extended to cover the Kibos River catchment and the area below the confluence of the two rivers. Silting and flooding in the Awach has been much improved.

Central Province

Meru Settlement Schemes.—On the Kimbo-Kiberichia Scheme all available land has been allocated. Good fences and farm buildings, sound rotations with grass leys are a feature of this scheme. There are now 256 farms and 1,124 one-acre plots on this scheme and 60 grade Guernsey cattle. Progress has been made on the other numerous schemes in this District particularly at Giaki where the general standard of farming has been good.

Embu Settlement Scheme.—There are 430 farms involved of which over 100 have been planned in detail or on a simple layout. Cash is derived from milk sales and pineapple production.

Kanja Dairy Scheme.—This scheme continued as a source of information on farming problems in the High Bracken Zone. While tea and coffee plots have shown reasonable results, pyrethrum has not done well and the grade sheep suffered casualties.

Ishiara.—Good rainfall in this area has enabled reasonable crops to be harvested outside the irrigated area and interest in organized irrigation on the scheme has declined. Experimental plantings of Excelsa and Robusta Coffee have done well.

Southern Province

Machakos District Reconditioning Scheme.—This work has now been absorbed into the normal extension duties of departmental staff the African staff having been taken into the establishment. Work on water supplies, soil erosion, control and the preservation of grass cover continued throughout the year.

Makueni Settlement.—To combat the tsetse fly infestation bush clearing continued. The larger farms which had proved too big for effective management were subdivided. There are now 2,102 registered settlers and a livestock population of 12,000 head. Crop husbandry has noticeably improved and terracing and benching constructed during the year has been extensive.

Coast Province

Gede Settlement Scheme.—There are 537 settlers, 578 demarcated holdings and a population of 2,815 on this scheme. The settlement officer was withdrawn in May and thereafter the scheme administered by the Department.

Shimba Hills.—The total number of settlers is 158 there being 45 vacant farms out of the 203 demarcated. 35 of the new settlers in 1959 were Nandi the remainder being Wakamba. Mixed produce from these farms is sent in weekly to Mombasa. Sugar-cane is being bulked for eventual sale to Ramisi.

Rift Valley Province

West Suk Grazing Scheme.—The areas involved are Riwa 56,000 acres, Kipkomo 43,000 acres, Batei 30,000 acres, Chesera 23,000 acres and Masol 142,000 acres. Stocking rates vary from 10½ acres per beast to 59 acres per beast. The Committee of Elders in charge of schemes have been extremely co-operative in this district.

Baringo District Schemes.—Individual holdings are being developed in Lembus Forest, Emening Triangle, Kabimoi and Chemagoch. Grazing schemes are in operation at Esageri now subdivided into Kisokon ranch and Kiptuim ranch, Gobat, Radad Perkerra and Cheberen. In addition there is the Perkerra catchment protection forest of 19,500 acres. In the Kerio catchment the Kabarnet ranch is being developed and a small irrigation scheme at Barwesa of about 100 acres. On the Solai border individual holdings are being developed at Kisamana and grazing schemes at Kisanana, Ngendalil, Ol'Kokwe and Mugerin.

Sarora Settlement.—During the year the first coffee was exported from this settlement. Building of a coffee factory started in November.

Kaimosi Settlement.—Good progress was made on this settlement and the demarcation of holdings, road layout and soil conservation framework were completed.

Soil and Water Conservation

The Senior Soil Conservation Engineer's headquarters continued to function as in previous years. Advisory work included general soil conservation problems, irrigation scheme layout, field drainage, swamp drainage, road culvert construction as well as the supervision of run-off experiments at Kericho and the approval of dams constructed by the S.C.S. for subsidy.

Soil Conservation—European Areas

Terracing.—Comparative figures of work done are set out below and further details given in Table E.

Acreages Protected by Soil Conservation Measures

District	1941–56	1957	1958	1959	Total
Trans Nzoia	58,825	4,426	2,465	1,384	67,100
Uasin Gishu	57,010	12,734	16,272*	12,568†	98,584
Nakuru	63,236	7,095	2,627	2,991‡	75,349
Thomson's Falls ..	43,988	10,764	4,869	5,028	64,649
S. Kinangop	11,906	6,562	5,656	5,280	29,404
Nyanza	9,153	1,079	979	234	11,445
Nairobi	5,429	501	684	185	6,799
	249,547	43,161	32,952	27,670	355,330

* Includes 12,500 acres cut-offs in Elgeyo and Nandi.

† Includes 7,300 acres in Elgeyo and Nandi.

‡ Includes 1,357 acres in Baringo.

Permanent Crops.—Work on tea, coffee, and sisal estates in the Nyanza and Nairobi plantation areas continued. The acreage known to be protected by various soil conservation methods is given in the table below:—

SOIL CONSERVATION IN PERMANENT CROPS (ACRES)

	Up to 1958	1959	Total
Sisal	12,319	700	13,019
Tea	5,778	728	6,506
Coffee	2,285	211	2,496
	20,382	1,639	22,021

Farm Planning.—The demand for this service continued unabated during the year. Particulars of work done are given below:—

FARM PLANNING, 1959

DISTRICT	Farms Surveyed and Mapped		Farms Planned		Total Planned 1951–59
	No.	*Acres*	*No.*	*Acres*	
Nakuru	17	11,740	12	10,261	92,130
Uasin Gishu	7	20,320	11	74,503	129,902
Trans Nzoia	13	5,206	15	16,253	41,232
Thomson's Falls ..	12	15,631	4	12,927	45,278
S. Kinangop	4	2,800	—	—	—
Nyanza	2	2,596	—	—	6,345
Nairobi	1	282	1	282	11,373
	56	68,575	43	114,276	326,260

TABLE E—SOIL CONSERVATION SERVICE

Output of Terracing, etc., for the year 1959

DISTRICT	No. of Farms Treated by Tractor	ACREAGE PROTECTED BY				Total
		Broad Base and V Terraces	Diversion Ditches	Narrow Base Terraces	Bench Terraces	
Trans Nzoia ..	50	739	645	—	—	1,384
Uasin Gishu ..	115	2,823	9,745*	—	—	12,568
Nakuru	26	320	2,671	—	—	2,991
Thomson's Falls ..	24	—	5,028	—	—	5,028
S. Kinangop ..	31	260	3,020	20	—	3,300
Lumbwa	13	365	140	—	—	505
Nairobi	6	158	—	55	0·5	213
	265	4,665	21,249	75	0·5	25,989

* Includes 6,700 acres in Elgeyo and 600 acres in Nandi.

COMPLEMENTARY WORKS

DISTRICT	Roads	Excavation	Training Bank	Outlet Drain	Cut-off Drains	Small Dams
	yd.	*cu. yd.*	*yd.*	*yd.*	*yd.*	*cu. yd.*
Trans Nzoia ..	30,511	4,300	1,620	49,562	17,602	58,000
Uasin Gishu ..	92,159	125,080	2,483	15,739	16,223	151,970
Nakuru	107,180	—	1,870	8,140	79,770	71,300
Thomson's Falls ..	41,415	10,100	3,715	4,871	66,639	188,683
S. Kinangop ..	26,627	14,430	10,436	9,352	—	100,800
Lumbwa	18,652	2,000	—	2,819	923	—
Nairobi	4,736	12,616	150	6,508	2,392	22,675
	321,280	168,526	20,274	96,991	183,549	593,428

Land Preservation Orders.—The Director of Agriculture issued 16 Orders under the Agriculture Ordinance in 1959 of which nine were to remove previous Orders from the register, one was subsequently removed from the register and six required the cessation of cultivation in prescribed areas the protection of river banks and drainage ways or the limitation of stocking. In the Nairobi District, River Scouts were responsible for 1,772 acres of terracing on labourers *shambas*.

SOIL CONSERVATION—AFRICAN AREAS

Nyanza Province.—The Luo areas continue to be the worst areas in the Province and in some areas the position is deteriorating as cultivation extends and cattle tread the countryside unrestricted. Elsewhere in the Province the position is reasonably satisfactory but there has been a fall off in work done since communal labour has been abandoned. Elgon Nyanza District had a successful campaign to get a better cover of grass strips. In Central Nyanza after a long delay the African District Council passed a series of land usage by-laws.

Rift Valley Province.—Conservation problems are being tackled vigorously in this Province by means of grazing schemes in the semi-arid areas and comprehensive skeletal planning in the mixed farming zones. Surveying for skeletal planning was completed in the Mnagei location of West Suk. 5,000 acres laid out in Elgeyo and plans laid for similar work in Nandi District. Bench terracing and narrow-base terracing continue in the hill areas of Elgeyo, Baringo and West Suk together with grass planting and the issue of tree seedlings.

Central Province.—There has been some deterioration in the maintenance of conservation works in this Province due in part to the need to concentrate on the follow up with simple farm planning after land consolidation. As planning extends to cover more and more individual farm layouts the overall picture is expected to improve. Even so parts of this Province viewed from the air present a remarkable picture of neat, well laid out and well looked after farms which are a monument to years of effort and exhortation by successive Agricultural officers.

Southern Province.—The enthusiasm of the Wakamba for adequate soil conservation measures continued during 1959. Over 6,000 acres were bench terraced, 20,000 acres protected by grass strips, 27,900 acres of live wash stops planted, over 59,000 acres of bush cleared, 11,000 acres of veld scratch ploughed and reseeded and 21,000 acres paddocked. "Mwethia" self-help groups made an important contribution to this work in some locations.

Coast Province.—Protection continued by means of contour banks, trash lines and live wash-stops over 10,000 acres being treated during the year. Over 200 eroding *shambas* were closed to cultivation under local by-laws. Extensive areas, however, still require protection in this Province.

Water Conservation—Mechanical Dam Construction Units

The work done by the mechanical units is detailed in the table below:—

DAM CONSTRUCTION, 1959

UNIT	No. of Dams and Water-holes	Earth Moved	Water Storage	Cost per Cubic Yd.	Tractor Hours Worked	Mean Output per Tractor Hour
		cu. yd.	*mil. gal.*	*Sh.*		*cu. yd.*
HEAVY—						
D.C.U.	Kitui Dam	98,498	40	2·81	5,251	18
	Machakos Dam (incomplete)	140,000	350	3·30	—	—
	Other Work	107,228	—	1·70	—	—
S.C.S. UNITS—						
Eldoret	41	151,970	29	—	1,549	98
Thomson's Falls	22	188,683	160·51	—	4,682	40
Kitale	8	58,000	32·50	—	1,440	40
Nakuru	16	71,300	41·35	—	1,668	42
Ruiru	1	22,675	—	—	830	27
Lumbwa ..	—	—	—	—	—	—
S. Kinangop ..	9	100,800	36·15	—	3,066	32
TOTAL ..	99	939,154	689·51	—	18,486	42

The heavy Dam Construction Unit was engaged on operations at Kitui, Hola and Machakos during the year. At Kitui the Township Water supply dam was completed and other minor works dealt with in the township. At Hola Irrigation Scheme now renamed Galole work included 247 acres of bush clearing, canal construction, stripping of top soil and sewage lagoon construction. At Machakos work on the construction of a large township water supply dam commenced in July. The dam is not yet complete but will be approximately 70 ft. high when finished. This construction is being undertaken for the Ministry of Works.

Water Supplies—African Areas

The work done in the Provinces is outlined below:—

Southern Province.—Soil conservation units constructed two large dams in Machakos and three water-holes in the Kitui District. Communal effort resulted in the construction of one large dam and 12 small dams in Machakos and seven small dams in Kitui. Other work in Machakos included 56 subsurface dams, three bore-holes, one well, one rock catchment dam and 2,539 small stone check weirs in dry stream beds. In both Kitui and Machakos pipeline schemes are under construction.

Coast Province.—The pipeline from Lata dam to Mwarapu at the foot of Sagalla in Taita District was completed. Water is lead to a 10,000-gallon tank from which it is taken to stand-pipes and cattle troughs. The dam, however, dried up periodically. In Kasigau water was piped from a permanent stream high up above Rukanga through the forest to the existing rock catchment dams. A stand-pipe was erected in the village of Rukanga and the resulting supply has so far proved adequate.

Nyanza Province.—An ALDEV unit completed nine small dams costing a few hundred pounds each in the western locations of Central Nyanza District. These have proved popular locally with the result that the African District Council has taken out a loan to finance a further programme of 30 to 40 similar dams. A similar ALDEV unit in South Nyanza put up 14 dams during the year. In North Nyanza attention was devoted to the building of fish ponds which have caught on in a big way there being some 2,000 in the district. In the Kisii Highlands and Kericho Districts the use of corrugated iron roofs and water tanks has proceeded so rapidly that it is no longer possible to keep a record of numbers.

Central Province.—A number of minor irrigation furrows were constructed some for coffee factories. Bore-hole sinking with drill rigs continued and one dam was constructed.

Rift Valley Province.—Ten water holes were constructed during the year in Baringo District bringing the total to 63. In addition 33 springs were protected bringing the total to 87. Piped water supplies in Baringo cover 9,000 acres. Water reticulation schemes in Elgeyo totalled ten by the end of the year. In Nandi District 36 wells were sunk during the year, 318 springs have been protected four pumped schemes and 12 hand-pumped water schemes installed.

Field Drainage

In Nakuru the dry year prevented a programme of about 600 acres of mole draining in the Londiani area from being carried out. In the Uasin Gishu and Trans Nzoia surface drainage work was carried out by S.C.S. Units on 150 acres. The South Kinangop Unit acquired a trench cutter for drainage work. Considerable acreages of ridge and furrow have been set out for farms. The main disadvantage of this system is the reduction in crop growth in the furrows. In the Nairobi District camber bed construction in vleis in the area amounted to 57 acres and a further 82 acres were surveyed by the S.C.S. Unit for construction.

Irrigation

Irrigation Development Projects

The General Manager, Irrigation Development Projects, reports as follows:—

On the whole it has been a very satisfactory year on the Mwea-Tebere and Tana River Irrigation Schemes but it continues to be most disappointing on the Perkerra Irrigation Scheme.

In spite of many frustrations and setbacks the staff on all three schemes have worked extremely well and have tried their hardest to make a success of the schemes.

With the exception of Perkerra, Tenants are working really well and show a keen interest in their holdings.

Mwea-Tebere Irrigation Scheme

Development.—On the black soils the whole of the Tebere "A" and Nguka Swamp areas have been completed, totalling 3,438 acres. Work has also commenced on the 1,574-acre extension in the Mwea area and by the end of the year 198 acres of this area had been levelled, of which 195 acres had been completed with structures.

Thus during the year under review 1,547 acres were levelled and concrete structures, etc., completed on 1,885 acres. All land preparation has continued to be carried out under the direction of the Hydraulic Branch (Ministry of Works).

No further development has taken place on the red soils.

The new headworks on the Thiba River to supply water for the Mwea extension has been completed. The canal to supply both Nguka and Mwea areas is being constructed mechanically.

Settlement.—There are now 824 tenants settled on the land each on a four-acre holding, leaving a balance of 146 settlers to be given tenancies during the coming year. There are 979 women and 2,337 children all being the families of tenants and settlers.

On the whole the tenants have again worked extremely well and the demand for tenancies continues to be considerable.

Crops.—Rice planted during the Short Rains of 1958 on 1,231 acres was harvested during the first quarter of 1959 and produced an average yield of 20.31 bags (160 lb.) per acre. The later sown fields did not produce as well as expected but the average *net* return to the tenant was £109 from his four-acre holding.

No rice was planted during the Long Rains and the land was allowed to remain fallow. Seed beds were sown in early August and transplanting commenced at the beginning of September. Harvesting commenced towards the end of December. An estimated average yield of 25 bags (160 lb.) per acre is anticipated.

The scheme has been remarkably free from *Quelea* (Sudan Dioch) this year as a result of the measures taken to exterminate this pest over the past few years. This is certainly a triumph for the Bird Control Officer.

Experiments and Trials.—The fish trials with *Tilapia nigra* on Tebere "A" were discontinued owing to the impossibility of maintaining them as it was found necessary to treat the canal water with anti-bilharzia chemicals.

Experiments with various crops have continued in the red soil area.

Tomatoes have continued to be grown for sale to Kenya Canners. The 21 acres sown towards the end of 1958 only yielded about 3½ tons per acre but the 34 acres planted in May averaged nearly 7 tons per acre. A further 16 acres were planted in November.

Approximately ten acres of hibiscus were planted early in the year for ribboner trials which were held in May. 27 acres were sown during November as a further trial to investigate the economics of this crop.

About one acre each of grapefruit, lime and orange have been planted out and are making fair progress. Tea plants are proving extremely difficult to establish.

Two and a half acres have been sown to Bombay Red onions and are doing well. Eight and a half acres of soya beans have also been sown.

Various other crops such as garlic, sorghum, tobacco, sunflower, potatoes, lucerne, and chillies have all been tried without much success.

General.—It has been another satisfactory year of steady progress as regards crops and tenants.

The Administration Authorities have spent a considerable amount of thought, time and hard work in endeavouring to find a means of setting aside the scheme area and assessing a fair rate of compensation acceptable by local clan right holders. Considerable progress was made towards the end of the year in finding an answer to the problem.

The Manager, Mr. Taylor, was transferred to Perkerra Irrigation Scheme in October and was replaced by Mr. Gilgioli, a trained agronomist with considerable experience in rice growing, who has been transferred from British Guiana.

A Grant's Drying and Cleaning plant for rice has been erected at Tebere and will come into operation shortly.

The internal telephone system has been completely realigned within the boundaries of the scheme. There is a rumour that the Scheme Headquarters may even be connected to the main telephone system shortly, this would save many journeys into Nairobi.

Only 12.56 in. of rain fell during the Long Rains compared to 21.34 in. during 1958. The Short Rains although late were above average. The year's rainfall as recorded at Tebere was 30.19 in. compared with an average over the past five years of 35 in.

PERKERRA IRRIGATION SCHEME

Development.—1,600 acres have now been levelled and completed with the necessary drops and field inlets. All further development was stopped pending a policy decision regarding the future of the scheme.

It had been intended to redevelop an area of some 438 acres of the earliest developed land as this had proved difficult to water and also extravagant in water usage. However, it was later decided not to do this redevelopment and to leave this area out of cultivation for the present.

The present irrigable area of the scheme is thus 1,162 acres.

There is no doubt that for ease of watering and particularly for control of night watering by tenants, the level basin system of irrigation is the best. However, the border strip system is more economical of water which is a vital consideration for this scheme.

Settlement.—At the beginning of the year there were 241 tenants on the land but by the end of the year this number had been reduced to 114.

Forty-eight tenants were sent to prison for failing to pay their water rates and only 74 old tenants remained to take up their holdings in March, the remainder resigned or just disappeared. 44 new tenants were taken on bringing the number up to 118 but this has now been reduced to 114 owing to further resignations by some who found the work too hard.

On the whole the standard of most tenants continues to be extremely poor. They are undisciplined and unco-operative and take little interest in the scheme after the harvesting of their Long Rains maize crop. Absenteeism is frequent and on cattle auction days the whole scheme is deserted. There are a certain number of absent landlords who employ low calibre labour on their holdings whilst a number of tenants who are too lazy to work themselves, do likewise.

There are however several tenants who appear to be really trying and their crops are outstanding which just shows what the remainder could do if they really tried.

This is indeed very poor material with which to be asked to build a successful irrigation scheme.

Most tenants have now paid the water rates and agricultural services on their first crop, but it will be a very different picture when the time comes to collect the moneys due on their second crop.

It is now proposed to build houses on their holdings for all tenants in the hopes that it will encourage them to stay on the holding and feed their cattle on their grass acre.

Crops.—With a few exceptions the tenants established their maize crop in a satisfactory manner and initial growth was good. However, as usual it has been impossible to obtain correct yield figures from the tenants but it was estimated to average about 11 bags per acre, the highest admitted being 16 bags per acre.

The scheme-grown maize again suffered severely from theft and the yield was disappointing though on one acre it averaged 17 bags per acre.

For the second crops tenants were instructed to grow groundnuts, beans and gram. In many cases ploughing and ridging was delayed because of the failure of the tenants to clear the first crop debris when told to and it was only by constant pressure by the management that the bulk of the tenants had anything sown by the end of October.

Unfortunately the groundnut seed supplied was of poor viability and the original germination was patchy. Despite repeated instructions most tenants failed to infill and the resultant crop will not be good.

Some of the early planted beans failed owing to bean fly but again tenants failed to do the necessary replanting. The later planted beans which were treated with Aldrin have done much better but have suffered from lack of weeding.

Green gram has done reasonably well because its vigorous growth suppresses the weeds and thus it requires the minimum of effort to maintain.

With only a few exceptions the grass acres have been completely neglected. These were put in to provide fodder for their cattle. They now state that it is too difficult for them to take their cattle to their holding each day and are asking for exemption from water rate on that acre on the grounds that it has brought them in no profit. The truth is that if they used it as intended it would mean that they would have to be on their holdings each day.

Experiments and Trials.—In addition to groundnuts, beans and green gram, the scheme has also carried out field trials on castor, kalahari early pearl maize, hibiscus and onions.

Groundnuts suffered from poor germination due to poor viability of the seed supplied and despite infilling the yield will not be high. The tendergreen beans have done fairly well. Two loads of green beans have been sent to Njoro Canners and the remainder will be harvested for seed. Castor is growing well and the kalahari early pearl maize looks promising. The hibiscus has not been a success, it started flowering very early and even at 125 days it only averaged about 4 ft. in height. As it would not have paid the costs of harvesting and processing it was ploughed in. Harvesting of the onions has just commenced, it looks a most promising crop.

General.—It has been another very disappointing year and the future of this scheme gives cause for much anxiety. The tenants are certainly not of the right calibre and in addition no really high priced cash crop has yet been found which could be grown on a full field scale. Shortage of water is also another problem and in fact the whole scheme bristles with difficulties at present. Various alternative propositions are at present under consideration and it is to be hoped that a definite decision will be taken shortly as to what the future of this scheme is to be.

The area has at last been set apart and gazetted and irrigation rules have also been gazetted which will apply to this scheme and to the Mwea-Tebere scheme and to any other scheme gazetted as an irrigation scheme.

The Kikuyu labour which have been on the scheme for some years now are tending to drift away. Many of them had hoped to be given holdings on the scheme and were disappointed when told that this would not be possible.

Mr. Taylor was transferred from Mwea-Tebere to run the scheme on the departure of Mr. Richardson who completed his contract in August.

Rainfall for the year was 24.76 in. as compared with 30.16 for the previous year.

Very serious damage to growing crops has been caused by game, particularly Grant Gazelle. Whole fields of groundnuts, beans and gram have been stripped completely bare. Wart-hog damaged the maize crops and Crested Crane are adept at destocking newly planted fields of maize and groundnuts. It is certain that if crops are to be grown on this scheme then the surrounding game will have to be decimated.

TANA IRRIGATION SCHEME

Development.—During the year the second 400-acre development was completed and work started on the third 400-acre development project. Because the number of people for whom land must be found has now been considerably reduced the final area has been agreed at 1,200 acres.

It had been intended to try and complete this 1,200 acres by the end of June, 1959, but as there was no urgency for the time being and labour was required for completing a revised building programme, it was decided to delay it and complete the 1,200 acres by 1st April, 1960.

Work on the new area continues. The Dam Construction Unit was called in to complete the bush clearing of about 1,200 acres in order to speed up survey work. It also dug a new subsidiary canal taking off from the old main canal and prepared some pads and drains. Convict labour are now working on excavation of drains and a start has been made on building structures and on land preparation. Recent shortage of convict labour may jeopardize the completion on time of these 400 acres.

A new pump and pontoon have been ordered from U.K. and are due to arrive in February and it is hoped to complete installation by the end of March.

Settlement.—During the Short Rains 1958/59 there were 122 tenants settled on 398 acres, for the Long Rains 1959 there were 133 tenants on 416 acres and in the Short Rains 1959 there were 149 tenants on 600 acres. Owing to the release of many restrictees there was a continual change in the tenantry. Only 31 tenants have cultivated for all three seasons and only 33 had a full year on their holdings.

The majority of the tenants have worked well.

The two tenants' villages are nearing completion, both have filtered water supplies.

Crops.—Cotton has continued to be the best cash crop, the type grown being U.K.51. 300 acres were sown by tenants in May and harvested in October/November. It was severely damaged by American Bollworm in August and in spite of five aerial sprayings there was a considerable loss of bolls. The final yield was just over 800 lb. to the acre, all "A" Grade. It is presumed that the tenants disposed of their "B" Grade elsewhere, probably for stuffing mattresses, etc.

Maize does not give a high yield but as usual it is difficult to get a correct figure from the tenants but it probably averaged about eight bags per acre.

Soya bean may well prove a useful second cash crop if the right variety can be found. The Hernon 235 planted in the Short Rains of 1958 only gave about 400 lb. of seed per acre. The most promising variety would appear to be Bukura which is suitably short term and yields well. This variety has been sown in the 1959 Short Rains.

Experiments and Trials.—Experimental work on both red and yellow soils continued, the emphasis being on crop trials, particularly cotton and Soya bean and on pest control and watering régimes.

An Assistant Agricultural Officer has been posted to the scheme to deal with the experiments.

The Egyptian cottons continue to do well on an experimental basis but they take too long to mature to fit in with the double growing season. The most hopeful other type that has been tried on a field scale was Ilonga (ex Tanganyika) which is intended for irrigation. Not only was its maturing period shorter than U.K.51 but it gave a yield of over 2,000 lb. to the acre.

Much work has been done on Soya beans, one trial having 23 varieties. Work continued on jute but this has now been abandoned. Some work has continued on the residual effects of leaching and of chemical treatments.

Date palms have grown with amazing vigour and look like ripening some fruit.

A tree nursery has been started and also seed beds for onions.

General.—On the whole a satisfactory year's progress.

Although there have been periods of crisis the irrigation system has worked well on the whole. The main difficulty that has arisen has been the silting up of the main canal. This became so bad that latterly the canal would not pass more than about 7 cusecs. A hired dragline arrived at the beginning of November to start clearing the canal and this was joined in mid-December by another one bought for the scheme. Both machines are now busily engaged in desilting and widening the main canal.

Although the number of convicts in the Prison has been reasonably maintained there has been a great reduction in the restrictee force available as labour and as a result increasing numbers of Wapokomo have been employed and at present over 300 a day are being used.

As a result of the incident of 3rd March, 1959, the name of the scheme was changed to the Tana Irrigation Scheme and the area is now known as the Tana Settlement with its headquarters at Galole.

In order to give the average tenant a reasonable income it was found necessary to subsidize the crop prices for both the Soya bean and cotton crops as the yields of both are not sufficiently high to enable the tenant to meet all his liabilities such as cost of water rate, ploughing, spraying, etc., and also leave him the necessary surplus on which to exist.

Agricultural Education

The Training of Agricultural Instructors

Particulars of the instructors in training at the centres at the end of the year are given below:—

Two-year Course

Province	*First year*	*Second year*	*Total*
Nyanza (Siriba)	26	25	51
Central (Embu)	59	19	78
Rift Valley (Kaimosi)	22	—	22
	107	44	151

To effect economies the training services were reorganized during the year. Matuga was closed down and 19 second-year students were transferred to Embu. The seven first-year School Certificate students at Embu were transferred to Siriba in February and the seven second-year students passed out in April leaving Embu to concentrate on the training of K.A.P.E. level instructors and Siriba the School Certificate students.

Of the 25 second-year students who sat their final examination in December at Siriba five failed. Refresher courses for departmental staff and farmers were held at Kaimosi and Embu during the year.

Plans are now well advanced for the development of diploma training at Siriba with the assistance of generous grants from the Rockefeller Foundation and the Hindocha Trust.

Farm Institutes.—The creation of facilities to provide short courses on agriculture for numbers of farmers made good progress in Nyanza where the Bukura Centre was opened during the year to serve Elgon and North Nyanza Districts. The centre at Kabianga was opened to serve Kericho District and facilities for Central Nyanza were provided at the Jeanes School, Maseno. South Nyanza will be catered for by a centre at Kisii which is nearing completion. Courses lasting for two to three weeks are provided and it is hoped that when in full operation some 5,000 people will pass through these centres annually in Nyanza Province. For Rift Valley Province farmers courses were provided at the Kaimosi Centre and these proved very popular. In Central Province similar facilities have been developed in Meru District at Kaguru, in Embu at the Agricultural Training School, in Nyeri at Wambugu and in Kiambu at Thogoto. Fort Hall is to be served by a centre at Mariira. Institutes are also planned at Kitui in conjunction with the Medical Department and at Machakos to serve Southern Province.

School Gardens.—In Nyanza agriculture in all the schools primary, intermediate and secondary received attention from our field staff and the examination of secondary school students and teacher trainees continued. Progress in general depends on the enthusiasm of the headmaster.

Young Farmers Clubs and Better Farming Societies.—There are now 12 clubs functioning in Coast Province although their activity has not been very great. Interest has declined in the European areas since the withdrawal of a departmental officer from organizing duties for economy reasons.

In the Rift Valley Province a big effort has been put into the organization of field days for the European farming community. An interesting development was the building of a small hostel at the Eldoret Experimental Farm for the purpose of accommodating young people interested in learning the practical aspects of farming. Bush schools proved popular in the Coast Province and a good method of putting over simple agricultural improvement.

The Department staged exhibits at the shows organized by the Royal Agricultural Society of Kenya and successful district shows were held in Elgeyo, Elgon Nyanza, and Embu. Particular mention must be made of the outstanding exhibit mounted by Central Province staff at the Royal Show, Nairobi in 1959 illustrating the enormous development in African Agriculture in recent years.

Marketing

Produce Marketing and Inspection

Details of the quantities and value of produce that passed through the markets in 1959 are given in Table D. The position in the African areas during the year was as follows:—

Nyanza Province.—The Nyanza Marketing Board provided a very good service to Nyanza Province producers handling all African-grown crops except coffee, tea, pyrethrum, wattle bark and vegetables and fruit. The Board was responsible for handling crops with a gross turnover value of over £2,000,000. The Board assisted in the supply of good seed to producers and sales of insecticide for the preservation of harvested crops included 2,080 1-lb. packets, 240 ¼-lb.

packets and 943 6-oz. packets of various proprietary brands. Regular broadcasts of marketing information were made and the issue of monthly bulletins increased in accordance with a swelling demand.

Central Province.—The Central Province Marketing Board began operating in June with initial activities largely confined to produce previously handled by Produce Control. This Board is also handling the coffee cess which is designed to augment the Coffee Advisory Services in the Province.

Southern Province.—Much information has been collected on the marketing pattern in the Province and attention devoted to seeking alternative markets to supplement the main Nairobi outlet. Tomatoes have been exported to Aden and passion fruit to Covent Garden by air freight. The demand for fresh produce in Mombasa has also received attention.

Coast Province.—The inspection of the cotton and cashew nut crops continued in the Coastal districts—other products inspected included copra. In Taita District wattle was inspected at Mwatate and Bura and the standard remained high throughout the season. Exports of mangoes went to the United Kingdom, Belgium and Aden from the Malindi area where a packing station is now under construction.

Rift Valley Province.—The part-time services of the Marketing Officer from Nyanza in Nandi District proved of great assistance to that district. Some anxiety is however felt over the disposal of increased cash crop production from Elgeyo District. Marketing problems are virtually non-existent in West Suk and Baringo. The latter district is forming a co-operative in Kabimoi to deal with maize redistribution within the district.

Co-operation

The growth of societies in Nyanza continued although not without "growing pains" particularly in South Nyanza where differences of opinion arose between technical officers of the Department and the Coffee Union and indicated the need for tighter control. Three inefficient and unco-operative societies continued to supply very low grade coffee. In Central Province 94 coffee pulping stations are owned by 45 societies. All are based on three-disc pulpers with either rotary or Aagard Screens and are generally powered by 3¼ h.p. petrol/paraffin engines. Much attention has been given to the development of drying facilities by these societies since a large proportion of the crop comes in during the rains and Gathano mists affect some areas. Bed driers have proved satisfactory and two have been installed in Meru District.

In the Coast Province the Taita Coffee Growers Society had a good year and a pyrethrum society is being formed. In Malindi a society was formed to deal in the first instance with the marketing of high quality mangoes from that area.

Grading and Inspection Services, Mombasa

Inspection.—There was a general increase both in quantity and value of imports as compared with 1958. The number of packages of plant and plant products inspected rose to 567,094 valued at £2,711,293.

Imports of fresh fruit were similar to those of 1958 but the quantity of Australian apples fell as against an increase in imports of Italian apples. Fresh fruit from Israel, a new feature, included citrus, melons and pomegranates.

Imports of onions from Egypt and the Lebanon continued mainly in the first half of the year. Large importations of Egyptian garlic caused considerable difficulty being heavily contaminated with soil and imports ceased toward the end of the year.

There were two importations of Queensland Wheat amounting to approximately 17,649 tons.

Forty-three infestations of *Trogoderma granarium* were observed during the year. Seven were found in shipments of rice from Pakistan, and two in cargoes of starch, rice and pulses from Dar es Salaam. The remaining 34 were in mixed cargoes of foods and spices from India. None was found in malt.

Grading.—The exportable surplus of Kenya maize proved to be less than had been anticipated and by the end of April shipments of white maize ceased. Only one shipment of yellow maize was made in August. Shipments were in the main to European ports. Quantities graded are shown in the table below. The total number of shipments made was seven.

All maize exported was fugimated with Methyl Bromide prior to shipment by the Maize Marketing Board. Departmental staff carried out post-fumigation inspections and no failures were reported as compared with the previous year. Small shipments of ungraded maize went to the Seychelles. Other shipments of ungraded maize of Tanganyika origin went to Venice and London.

Exports of beans increased considerably, the total quantity submitted for grading amounting to 94,256 bags compared with 54,298 in 1958. Mixed beans were the principal export increasing from 558 bags in 1958 to 26,315 in 1959. Principal customers were South Africa and the Central African Federation. Shipments of seed beans amounted to 60,889 bags mostly of Tanganyika origin.

The rise in the volume of potato exports continued and a total of 70.750 cwt. were examined of which 68,305 cwt. were graded as K2 and 2,445 rejected. Principal supplying areas were Elburgon and Meru. All exports of potatoes were of Kenya origin.

Exports of chillies and capsicums declined markedly as compared with previous years. Uganda chillies, which constituted the majority of parcels graded again showed little improvement in quality. Capsicums were disappointing and the proportion of undergrade samples increased.

The inspection of horticultural produce for export was considerably tightened up during the year. A total of 529 certificates under Agricultural Produce (Horticultural Produce Inspection) Rules were issued compared with nine in the previous year. Mixed fruits and vegetables were the principal items examined.

PRODUCE GRADED FOR EXPORT (BAGS), 1959

	Maize	Wheat	Beans	Potatoes
				Cwt.
K.1	—	—	—	—
K.2	—	—	—	68,305
K.3	—	108	17,931	—
K.4	606,520	92	7,293	—
K.5	—	—	—	—
K.6	—	—	67,215	—
R.J	4,245	—	1,817	2,445
Total 1959	610,765	200	94,256	70,750
Total 1958	1,114,141	2,233	54,298	65,070

Figures for chillies graded are as follows:—

CHILLIES GRADED FOR EXPORT (BAGS) 1959

	Capsicum Minimum	Capsicum Annuum	Total
G.A.Q.	84	—	84
F.A.Q.	146	5,546	5,692
Undergrade	3,136	6,161	9,297
Reject	—	55	55
	3,366	11,762	15,128

Entomology.—The Entomologist (Stored Products) was engaged on storage experiments and investigations into the use of Malathion and a number of routine inspections of ships and storage premises were made. He also inspected up-country grain stores and visited Dar es Salaam to investigate an infestation of *Trogoderma granarium* in imported wheat.

Revenue.—Revenue from grading and plant inspection fell by over 20 per cent in 1959 to Sh. 95,665/90 cents.

Quelea Control

This year may prove to have been the turning point in the success of efforts to solve the *Quelea* problem. Until 1959 it was doubtful if control measures within East Africa were keeping pace with the ever increasing population development. Increased knowledge of the *Quelea* breeding grounds and the development of better and more economic aerial spraying techniques give hope that with additional finance available in Tanganyika numbers may be so reduced over the next few years that the species will no longer constitute a major threat to small grain growers in large areas of East Africa. Should this prove correct routine control at source would be sufficient to prevent future outbreaks.

CONTROL AT BREEDING COLONIES

A campaign was undertaken in the main Tanganyika breeding grounds where 1,525 acres of breeding colonies were dealt with in 15 operations. A total of 91.572.000 *Quelea* were destroyed. Of this total 38,600,000 adults and 34,250,000 young were accounted for by the new aerial spraying technique using 516 gallons of parathion over 1,050 acres.

CONTROL AT ROOSTS

A very large roost was found near the Mwea-Tebere irrigation scheme in January which if left would have resulted in the destruction of the entire crop. It was at this roost that the new curtain-spraying method was evolved. At this roost and another at Olelondo just under 3,000,000 *Quelea* were accounted for. Comparatively few birds entered the Rift Valley wheat areas later in the year and although 15 blow-ups were undertaken only an estimated 350,000 birds were destroyed.

PART IV—GENERAL

Library

Economy measures prevented much progress being made with building up basic libraries in the provinces and indeed making adequate additions to the headquarters library; research stations came off best having other funds at their disposal. During the year a generous gift of books was made by the United States Information Services to farm institutes and agricultural training schools. The following journals were added to those already taken by the Department: *European Potato Journal, Biometrics.* Four issues of the *Newsletter* appeared during the year.

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Legislation

The more important legislative measures enacted during the year were:—

1. *The Maize Marketing Ordinance,* 1959.—The principal object is the establishment of a maize marketing board with comprehensive functions for the betterment of the maize industry. This had become necessary as the existing organization operated under the Defence (Control of Maize) Regulations, 1944, which were not part of the permanent legislation.

Part II of the Ordinance provides for a Board with corporate status, the primary functions of which are set out in Part III (section 13), which deals generally with the regulation and control of maize and maize products. Part IV deals with the control of imports and exports, Part V with millers—Part VI with financial powers, revenues and accounts, Part VII with the maize cess, Part VIII with offences and Part IX with general matters such as appeals, regulations, adaptation, revocation and repeal of existing laws.

2. *Land Development Loans Rules,* 1959.—These deal only with loans to farmers in Scheduled (European) Areas. The conditions for a loan are laid down and define the developments for which a loan, on a long- or short-term basis, may be granted.

3. *Marketing of African Produce Ordinance.*—Establishment of a marketing board for Central Province.

4. *Native Lands Trust Ordinance.*—The Native Lands (Irrigation Areas) Rules, 1959. These rules give legal sanction to the creation of irrigation schemes in the African areas and lay down the conditions to be observed in their administration.

5. *Pig Industry Ordinance.*—Operation of Quotas Rules. Registration of African Pig Producers Rules.

Staff

Three newly trained Agricultural Officers arrived from Trinidad in July—Messrs. R. C. Bond, J. G. Williams and R. D. W. Betts. Another Agricultural Officer Mr. E. G. Giglioli arrived on transfer from British Guiana to take charge of the Mwea-Tebere Irrigation Scheme. The Research Services were strengthened by the appointment of Mr. E. Hainsworth. Senior Research Officer (Plant Pathology), Dr. T. M. Wormer, Plant Physiologist and Messrs I. D. Firman and R. T. Clarke, Plant Pathologist and Statistician, respectively. 27 Assistant Agricultural Officers were recruited during the year, one of whom subsequently resigned and by the end of the year the number of vacancies in the establishment was reduced to 12.

A number of promotions were made during the year, Mr. A. Storrar was promoted Deputy Director in November taking the place of Mr. L. H. Brown who was transferred to the post of Chief Agriculturalist which carries equivalent seniority and status. Mr. F. R. Barnes was promoted Agricultural Officer in the Oversea Service but has subsequently resigned. Mr. W. A. Burgwin was promoted Agricultural Officer (Kenya) on the C5—1 scale. Messrs. G. H. Dukes and N. K. Whitton were promoted to Senior Assistant Agricultural Officers in July and November respectively. Mr. K. R. Bock was promoted to Senior Scientific Officer and Messrs. P. F. C. Scott and S. W. Cooper to the rank of Senior Technical Officers.

During the year the Department bid farewell to Mr. A. H. Savile who retired in May from the post of Chief Agriculturist and Messrs. E. Cottington and A. W. Allen who retired after 31 and 21 years service respectively.

It is once again a pleasure to record a year of progress and my thanks are due to every member of the staff including the many hard working African Instructors who have made this possible.

R. J. M. SWYNNERTON,
Director of Agriculture.

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